Eastern Michaud Flats Superfund Site Off-Plant OU
Supplemental Surface Soil Radionuclide Investigation Work Plan
July 29, 2009

1.0 INTRODUCTION

FMC and Simplot propose collecting surface soil samples from decision units (DUs) that lie within the Off-Plant Operable Unit (OU) of the Eastern Michaud Flats Superfund Site (EMF Site). The identified DUs are located on properties that are not owned by FMC or Simplot and thus are within the Off-Plant OU. The Off-Plant OU was investigated during the EMF RI and the sampling previously conducted had been believed sufficient for characterization purposes. However, at the request of EPA, specific areas of the Off-Plant OU will be further investigated to review and update the findings of the RI in areas targeted for land use controls in the 1998 ROD, using current sampling and analytical protocols. The primary objective of this proposed sampling is to collect and analyze samples of surface soils for specified radionuclides to further evaluate human health risks to potential future receptors in these areas.

1.1 Background Information on the Off-Plant OU

The EMF Site is located in southeast Idaho, approximately 2.5 miles northwest of Pocatello, Idaho. The EMF Site was listed on the National Priorities List (NPL) on August 30, 1990. The EMF Site includes two adjacent production facilities, a former FMC Corporation elemental phosphorus processing plant that ceased operation in 2001 and a phosphate fertilizer processing facility operated by the J.R. Simplot Company. The EMF Site is shown on Figure 1 and encompasses both the FMC and Simplot plants and surrounding areas affected by releases from these facilities. FMC, Simplot and EPA entered into a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Administrative Order on Consent (AOC) in May 1991 under which the companies agreed to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the site. During the RI/FS the site was divided into three “Subareas:” 1) the FMC Subarea, consisting of the FMC plant and other FMC-owned properties at the site; 2) the Simplot Subarea, consisting of the Simplot plant and other Simplot-owned properties at the site; and 3) the Offsite Subarea, consisting of the remainder of the site. EPA changed these designations to the FMC Plant OU, the Simplot Plant OU, and the Off-Plant OU after its June 1998 *Record of Decision for the EMF Site* (*1998 ROD*, EPA, 1998).

As required under the 1991 AOC, FMC and Simplot developed a number of EMF Site studies and reports. These included the January 1994 *Preliminary Site Characterization Summary* (*PSCS*, BEI, 1994), the August 1996 *EMF Remedial Investigation Report* (*RI Report*, BEI, 1996), and the April 1997 *Feasibility Study Report FMC Subarea* (*FMC FS Report*, BEI, 1997), *Feasibility Study Report Simplot Subarea* (*Simplot FS Report*, MFG, 1997) and *Feasibility Study Report Offsite Subarea* (O*ffsite FS Report*, FMC Corp and J.R. Simplot Company, 1997). EPA reviewed and approved these reports. EPA conducted the baseline ecological and human health risk assessments concurrently with the companies’ RI/FS work and issued the final reports for those studies respectively in July 1995 and July 1996. The conclusions of those risk assessments were incorporated into the *FS Report* and the *1998 ROD*. The *1998 ROD* addressed all three Subareas/OUs at the EMF Site.

The Off-Plant OU includes urban commercial and residential areas, agricultural areas, and areas of rangeland for cattle grazing within the Fort Hall Indian Reservation and Bureau of Land Management (BLM) lands. As stated in the *1998 ROD*, the Off-Plant OU was divided into three areas, by reference to the three types of remedial action selected by that ROD:

- Areas Subject to Land Use Controls
- Areas Subject to Fluoride Monitoring
- Areas Subject to Company Monitoring for Residential Development

The areas subject to land use controls are the focus of this additional investigation. These are areas where the soil contaminant levels were found in the Baseline Human Health Risk Assessment (HHRA) to exceed a hazard quotient (HQ) of 1 for cadmium (reasonable maximum exposure [RME] case) and/or pose greater than a 1 in 10,000 excess lifetime cancer risk from radium-226. These areas include portions of the Interstate 86 (I-86) Right-of-Way; Chevron Tank Farm; City of Pocatello Property; a portion of the land owned by private party named [redacted], and a portion of BLM lands in the SW of the FMC facility. These areas are delineated by contours in Figure 27 attached to the *1998 ROD*. The proposed sampling targets these areas so as to update the characterization using current sampling and analytical protocols.

As shown on Figure 2, for purposes of this Work Plan, seven (7) separate DUs within the Off-Plant OU were selected based on the areas subject to land use controls. The DUs are located in the areas where radionuclide activities in surface soils exceeded the 10-4 incremental cancer risk level based on data collected during the RI. The risk contours as shown on Figure 2 were based on soil samples collected during the RI. The risk contour north of I-86 was based on concentrations detected in several RI sampling locations. Four of these locations (293-1B01, 293-1B04, 315-1B, and 000-1C) are located within the Off-Plant OU, and the rest are located within the FMC-owned Northern Properties section of the FMC Plant OU. The risk contour in the area southwest of the FMC Plant Site was based on only one RI sample location (248-3B).

1.2 Description of Off-Plant Decision Units

1.2.1 Decision Units North of I-86

Property located within the Off-Plant OU Land Use Control Area north of I-86 has been divided into five (5) DUs as shown on Figure 2 and described below.

Decision Unit 1 – City of Pocatello Property #1

This DU (46 acres) is entirely located on property owned by the City of Pocatello. The City uses this land for land application of sewage sludge from the City's POTW and leases the property for agricultural production currently consisting of wheat and/or hay crops.

Decision Unit 2 – City of Pocatello Property #2

This DU (45 acres) is located to the east of DU 1 and is entirely located on property owned by the City of Pocatello. The City uses this land for land application of sewage sludge from the

City's POTW and leases the property for agricultural production currently consisting of wheat and/or hay crops.

Decision Unit 3 – City of Pocatello Property #3

This DU (37 acres) is located to the north of DU 2 and is entirely located on property owned by the City of Pocatello. The City uses this land for land application of sewage sludge from the City's POTW and leases the property for agricultural production currently consisting of wheat and/or hay crops. This DU is adjacent to but does not include the active sand and gravel operation to the north.

Decision Unit 4 – Rowland Property #1

This DU (39 acres) is located to the north of the Chevron Tank farm and is located on property owned by Rowland's Inc. and/or (b) (6) [redacted]. The property is used for agricultural production currently consisting of potatoes, wheat and/or hay.

Decision Unit 5 –Rowland Property #2

This DU (33 acres) is located to the east of the Chevron Tank farm and is located on property owned by Rowland's Inc. and/or (b) (6) [redacted]. The property is used for agricultural production currently consisting of potatoes, wheat and/or hay.

1.2.2 Decision Units South of I-86

Two (2) additional DUs are located immediately south of I-86. These two (2) DUs are southwest of the FMC Plant OU and are located in a second area that was identified in the 1998 ROD as exceeding the 10-4 excess cancer risk for radium-226 as shown on Figure 2.

Decision Unit 6 – Southwest Quadrant #1

This DU (56 acres) is located partially on property owned by the Shoshone-Bannock Tribes (SBT) and partially on property owned by (b) (4) [redacted]. The portion owned by the SBT is primarily unused sagebrush steppe and the portion owned by (b) (6) [redacted] is used for agricultural production currently consisting of potatoes, wheat and/or hay.

Decision Unit 7 – Southwest Quadrant #2

This DU (57 acres) is located partially on property owned by the Shoshone-Bannock Tribes (SBT) and partially on property owned by (b) (6) [redacted]. The portion owned by the SBT is primarily unused sagebrush steppe and the portion owned by (b) (6) [redacted] is used for agricultural production currently consisting of potatoes, wheat and/or hay.

2.0 DATA QUALITY OBJECTIVES (DQOs) FOR THE OFF-PLANT OU

The following sections indicate the DQOs for the proposed sampling of the seven (7) Off-Plant OU DUs.

2.1 Problem Statement

Verify through surface soil sampling that there are no unacceptable human health risks in the Off-Plant OU to ensure that these areas are protective of potential human receptors.

2.2 Identify the Decision

The following decisions are associated with the investigation of human health risk within the boundaries of the each of the Off-Plant OU decision units.

- If the mean surface soil concentration of any radionuclide of potential concern (ROPC) in the DU is greater than the human health Comparative Value for that ROPC, perform a quantitative assessment of risks to residential and worker receptors for that constituent, consistent with the methods and assumptions documented in Appendix J of FMC's *SRI Report* (MWH, 2009) and Appendix D of FMC's *SRI Addendum Report* (MWH, 2009a).

- If the cumulative human health risk to potential residential or worker receptors from exposure to ROPCs in the DU is equal to or exceeds a cancer risk of 10^{-6} above background, the area will be compared to the 1998 ROD RAOs.

- If the mean surface soil concentration of all ROPCs in the DU is less than or equal to the human health Comparative Value, or cumulative human health risks are less than a cancer risk of 10^{-6} above background for any ROPC quantitatively evaluated, the area will be deemed to not pose a significant risk to human health receptors.

The human health Comparative Value for each ROPC is defined as the 95% upper confidence limit (UCL) on the mean background concentration (using FMC's 2008 SRI Addendum background sampling; MWH, 2009a) plus a residential or worker SSL developed in accordance with EPA Region 10 guidance (EPA, 2007). The SSLs, the 95% UCL background values, and Comparative Values (CVs) are provided for each ROPC in Table 1.

2.3 Identify the Decision Inputs

A total of eight (8) composite samples will be collected from each of the DUs to evaluate potential human health impacts associated with the deposition of historical air emissions from the FMC and Simplot facilities. Each of the composite samples will be comprised of 20 discrete surface soil samples collected from the 0-2 inch bgs interval. The 0-2 inch composite samples will be analyzed for the target radionuclide analytes uranium-238, radium-226 and lead-210.

The mean surface soil concentration for each ROPC from each DU developed during this supplemental sampling event will be compared to the ROPC-specific human health Comparative Values. As discussed in Section 2.2, a quantitative human health risk evaluation will be performed for any ROPC that is found to exceed its Comparative Value. The data for any ROPC requiring evaluation of human health risks will be used in conjunction with the risk assessment methods and assumptions incorporated into Appendix J of FMC's *SRI Report* and Appendix D of FMC's *SRI Addendum Report*, as inputs into the quantitative evaluation.

2.4 Define the Boundaries

Lateral Boundaries for the Off-Plant OU DUs

Figure 2 shows the lateral boundaries of the seven (7) DUs where the surface soil samples will be collected.

Vertical Boundaries for the Off-Plant OU DUs

The vertical boundary is the surface to two (2) inches below the surface (i.e., bottom of each sample interval) for every ROPC. Data from FMC's *SRI Addendum Report* (MWH, 2009a) will be used to evaluate the cancer slope factors for external exposure to gamma radiation, which assume uniform contamination to a depth of 6 inches, and this uncertainty will be addressed in the quantitative risk assessment, if necessary.

2.5 Develop the Decision Rules

Based on the human health risk decisions identified in Section 2.2, the null and alternative hypotheses are:

- H_0: The mean ROPC surface soil concentration in a DU <= the Comparative Value (i.e., 95% UCL on the mean ROPC background concentration + SSL).

- H_A: The mean ROPC surface soil concentration in a DU > the Comparative Value.

A quantitative human health risk evaluation, to be performed using the methods and assumptions documented in Appendix J of FMC's *SRI Report* and Appendix D of FMC's *SRI Addendum Report*, will be conducted for any ROPC that meets the conditions of the alternate hypothesis in an Off-Plant OU DU. The results of the quantitative evaluation will determine whether the DU is found to pose no significant risk to human health receptors.

In summary, the decision rules for human health risks are as follows:

- If the mean surface soil concentration of any ROPC in the DU is greater than the human health Comparative Value for that ROPC, perform a quantitative assessment of risks to residential and worker receptors for that constituent, consistent with the methods and assumptions documented in Appendix J of FMC's *SRI Report* and Appendix D of FMC's *SRI Addendum Report*.

- If the cumulative human health risk to potential residential or worker receptors from exposure to ROPCs in the DU is equal to or exceeds a cancer risk of 10^{-6} above background, the area will be compared to the 1998 ROD RAOs.

- If the mean surface soil concentration of all ROPCs in the DU is less than or equal to the human health Comparative Value, or cumulative human health risks are less than a cancer risk of 10^{-6} above background for any ROPC quantitatively evaluated, the area will be deemed to not pose a significant risk to human health receptors.

2.6 Specify the Tolerance Limits of Decision Errors

Because decisions will be based on 0.95 upper confidence limits on the mean, false positive errors will be limited to 0.05. The probability of false negative errors will also be calculated and presented within an Off-Plant OU report.

2.7 Optimize the Sampling Design

Sampling Design

The proposed sampling design remains consistent with the sampling and compositing methods described in FMC's *SRI Work Plan* and *SRI Field Sampling Plan* (*FSP*; MWH, 2007).

Visual Sampling Plan, v.4.3. (VSP) software was used to place 20-location square grids on a random origin across each of the DUs. A total of eight 20-location grids were placed across each of the seven (7) DUs as shown in Figures 3, 4, 5, 6, 7, 8 and 9.

For all gridded DU locations, the type of surface soil will be visually evaluated and logged in general accordance with the Unified Soil Classification System (USCS). One discrete surface soil sample will be collected in each of the 20 locations from the 0-to-2 inches bgs interval. The sample interval collected from each of the 20 surface soil locations will be combined and composited to create one (1) composite soil sample from 0-to-2 inches bgs from each of the eight (8) random origin grids. This will result in a total of 8 composite soil samples from each decision unit that will be submitted to the laboratory for analyses. Composite samples collected from the 0-to-2 inch bgs horizon will be analyzed for lead-210, radium-226, and uranium-238 for the purpose of evaluating potential human health risks.

Equipment and Procedures

A GPS unit with sub-meter accuracy will be used to locate each of the 20 discrete locations that will be combined to create a single composite sample. Individual surface soil sample locations will be collected according to SOP-15 of FMC's *SRI FSP*. In general, the surface soil samples will be collected by carefully removing the top layer of vegetative debris, should it be present, to expose the surface of the soil column. This material will be removed, if it is present, because the laboratory, unless instructed otherwise, will analyze the composite samples "as received." Therefore, extraneous material (e.g., larger rocks, leaves, sticks) will be removed at the time of sample collection.

A 6-inch square will be laid on the soil surface to mark the boundaries of each excavation prior to soil removal. The field team will use a decontaminated or one-use (i.e., disposable) spade, shovel, or equivalent to conduct this initial debris removal and to then excavate to 2 inches bgs. The field team will be careful to collect similar volumes of soil at each sample location and excavated soils will be placed in zip lock bags or other appropriate containers, then numbered so that the compositing can occur in a central location on site.

At each sample location, the sample bag will be placed in a two-cup sampling container (e.g., pyrex measuring cup) and filled to approximately the two-cup level. Individual surface samples will be identified by their DU number, composite sample number, discrete location, and depth. For example, within DU #1 the sample collected from the third composite sample (3) grid at the second discrete location from 0-to 2 inches bgs will be designated as “DU1C3-D2(0-2 in),” and the twentieth discrete sample collected from DU #6 for composite sample number five (5) from 0-to-2 inches bgs will be designated as “DU6C5-D20(0-2 in)”.

Gridded sample locations that fall on roadways will not be sampled. When the original sample location is not suitable or accessible, the location will be moved by randomly selecting a direction (north, south, east, or west) and moving five feet in that direction as described in FMC’s *SRI FSP*. This process will be repeated until a new surface soil sample location is determined.

Individual surface soil samples will be hand delivered to a central on-site compositing area. Each of the 20 discrete surface soil samples will be composited into one sample by the methods and procedures described in SOP-16A of FMC’s *SRI FSP*. The composited soil samples will be placed into new, appropriately-sized sample jars provided by the laboratory. One soil jar will be submitted for each 20-increment composite surface soil sample to the off-site laboratory.

Composite samples will be designated similarly to the discrete samples discussed above. Composite samples will be recorded sequentially at each area. The composite sample designation references the area from which it came (DU1 to DU7), the sample type (surface soil or SS) followed by the acronym “C” for composite, the sequential number of the composite, and finally the depth interval where the individual samples were collected. For example, the fourth composite samples from DU #2 comprised of soil collected from twenty (20) surface sample locations collected will be designated “DU2-SSC004(0-2 in).

Replicate soil samples will be collected at a rate of approximately ten (10) percent or one (1) per DU. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected a rate of five (5) percent. Equipment rinseate samples will be collected at a frequency of 1 per week. Samples will be analyzed for target radionuclides according to the methods and procedures outlined in FMC’s *SRI FSP*. Lead-210 will be analyzed by scintillation counting, radium-226 will be analyzed by radon emanation, and uranium-238 will be analyzed by alpha spectroscopy. All soil and water samples will be analyzed by Paragon Analytics of Fort Collins, Colorado. Data will be independently validated by Laboratory Data Consultants (LDC) of Sacramento, California.

Samples will be labeled, handled, and shipped following the sample handling protocols described in Section 5.0 and SOP-12 of FMC’s *SRI FSP*. Retained discrete samples will be maintained under chain-of-custody following Section 5.2 and SOP-4 of FMC’s *SRI FSP*. Non-dedicated sample equipment will be decontaminated according to SOP-3 of FMC’s *SRI FSP*. Equipment rinseate blanks and source water samples will be collected according to Section 6 of FMC’s *SRI FSP*.

3.0 DATA EVALUTION

An Off-Plant OU Focused Remedial Investigation Report will be prepared documenting the methods and results from the field investigation of decision units. The Report will include the human health risk evaluations as well as a data validation report.

4.0 REFERENCES

BEI. See Bechtel Environmental, Inc.

Bechtel Environmental, Inc. 1994. Preliminary Site Characterization Summary for the Eastern Michaud Flats Site. January 1994.

Bechtel Environmental, Inc. 1996. Remedial Investigation for the Eastern Michaud Flats Site. Bechtel Environmental, Inc. Draft issued September 1995 and revised August 1996.

Bechtel Environmental, Inc. 1997. Feasibility Study Report FMC Subarea. April 1997.

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MFG, 1997. *Feasibility Study Report Simplot Subarea.* April 1997.

MWH, 2007. *Supplemental Remedial Investigation Work Plan and Field Sampling Plan for the FMC Plant Operable Unit*. May 2007.

MWH, 2009. *Supplemental Remedial Investigation Report for the FMC Plant Operable Unit-Final*. May 2009.

MWH, 2009a. *Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit- Draft*. June 2009.

United States Environmental Protection Agency. 1998. Record of Decision. Declaration, Decision Summary, and Responsiveness Summary for Eastern Michaud Flats Superfund Site, Pocatello, Idaho. U.S. Environmental Protection Agency, Region 10. June 1998.

United States Environmental Protection Agency. 2007. *Recommendations for Human Health Risk-Based Chemical Screening and Related Issues at EPA Region 10 CERCLA and RCRA Sites*.

TABLES

TABLE 1
HUMAN HEALTH SOIL SCREENING LEVELS
FOR EVALUATING THE OFF-PLANT OU (pCi/g)a,b
FMC Corporation, Pocatello, Idaho

Constituents	Background Value (95% UCL on the mean)	Region 10 Residential SSL[c]	Residential CV	Commercial/Industrial Worker SSL[d]	Commercial/ Industrial Worker CV	Construction Worker SSL[d]	Construction Worker CV	Utility Worker SSL[d]	Utility Worker CV
Lead-210	2.02	0.45	2.47	0.94	3.0	7.4	9.5	96.7	99
Radium-226	0.95	0.013	0.97	0.023	0.98	0.93	1.9	12.3	13
Uranium-238	0.88	0.78	1.66	1.4	2.3	20.6	21.5	267	268

All concentrations in pCi/g.

a) The surface soil CV will consist of the Region 10 residential SSL + 95% UCL background concentration.

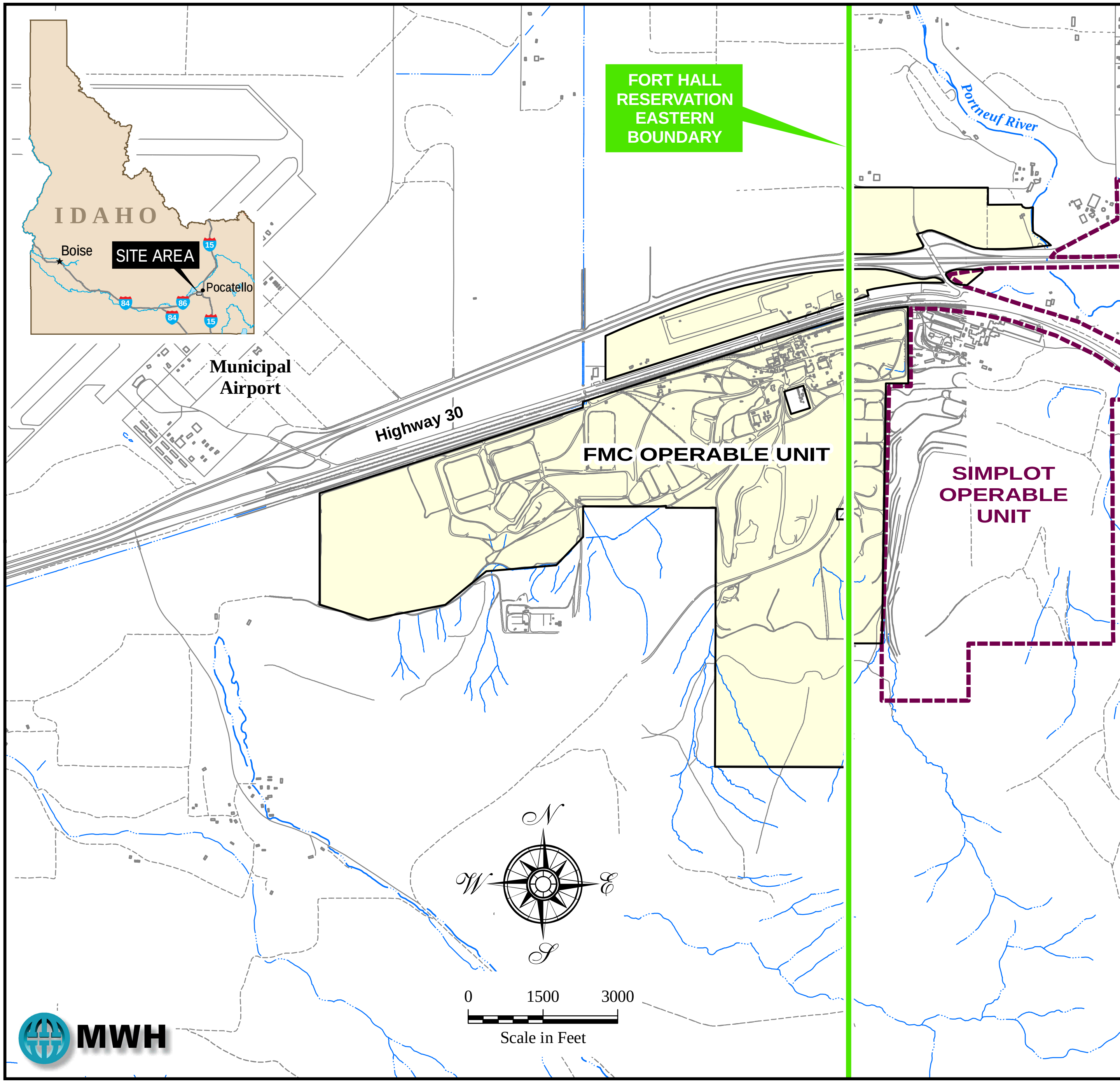
b) The sub-surface soil CV will consist of the lowest worker SSL + 95% UCL background concentration.

c) EPA Region 10 guidance recommends use of Region 6 screening levels. EPA Region 6 currently recommends use of EPA Region 3's Risk Based Concentration (RBC) Table for chemicals and EPA's Preliminary Remediation Goals website (http://epa-prgs.ornl.gov/radionuclides/) for radionuclides. Per EPA Region 10 guidance, residential SSLs established at a cancer risk threshold of 1E-06 and a non-cancer hazard index = 0.1

d) Worker SSLs taken from Table 1-7 of the SRI Report (MWH, 2009)

FIGURES

FILE Fig 1_Regional Setting_709.mxd 7/14/09

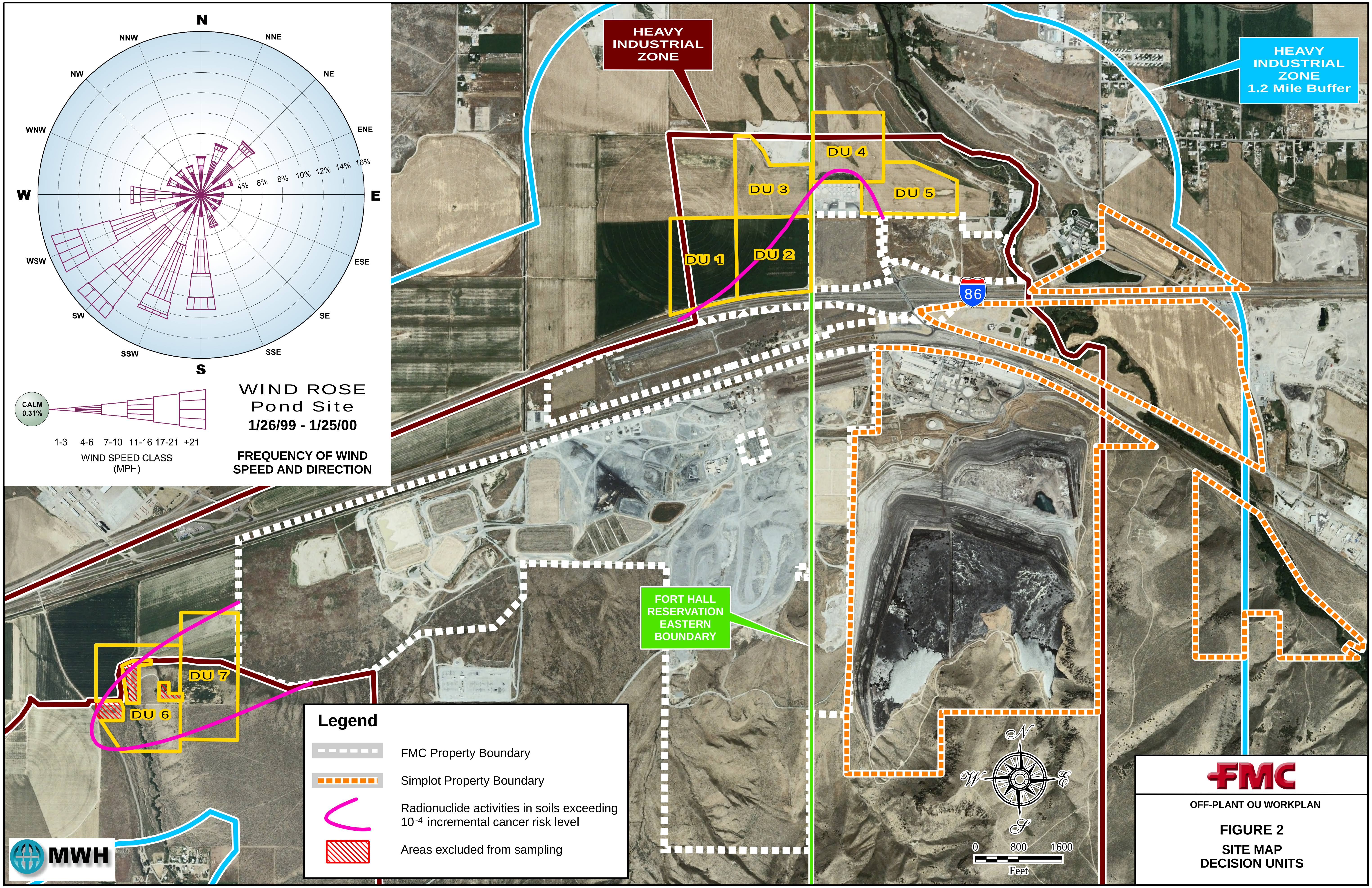


FMC

OFF-PLANT OU WORKPLAN

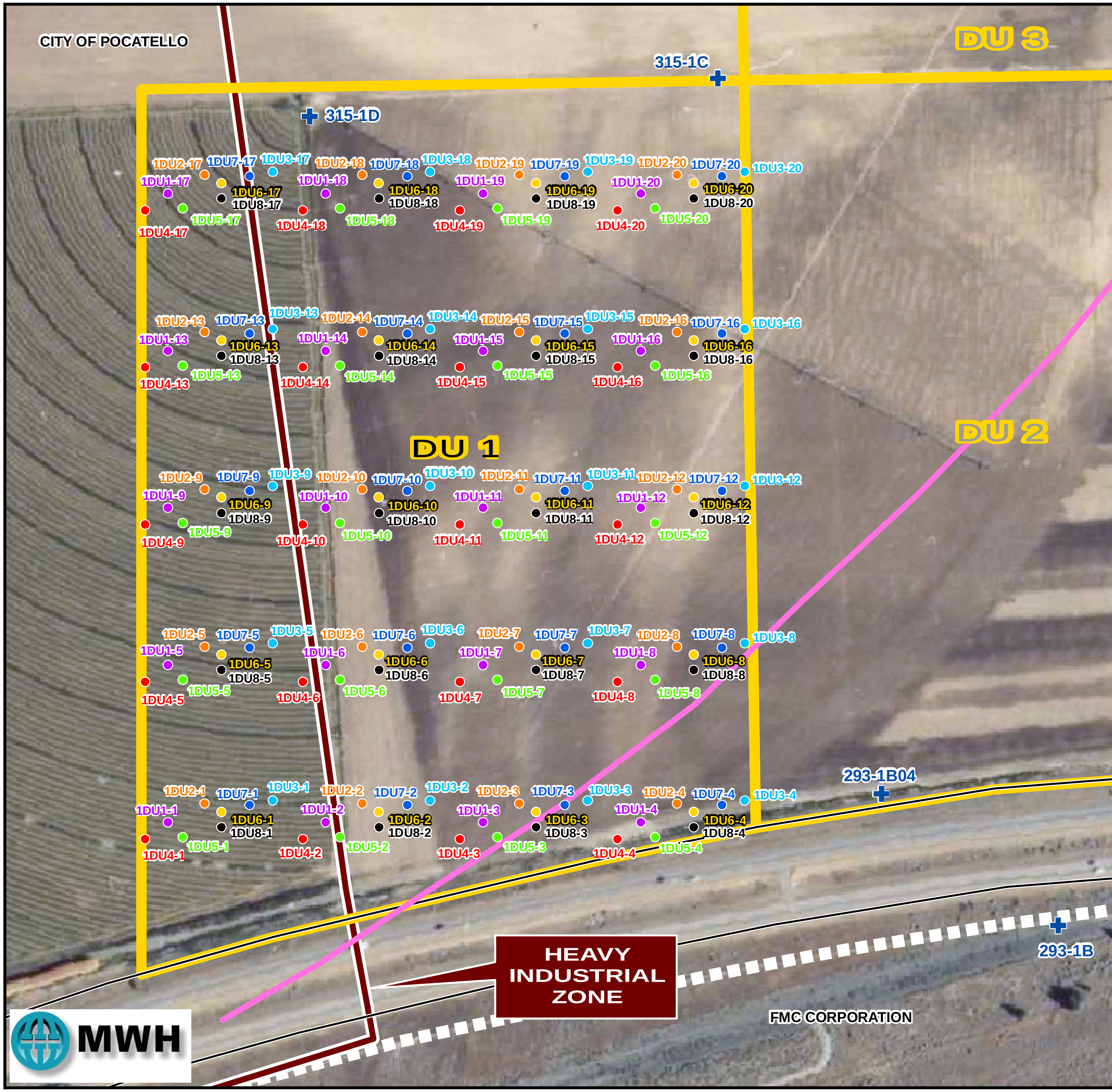
FIGURE 1

REGIONAL SETTING OF THE EASTERN MICHAUD FLATS SITE



FILE Fig 2_SITE MAP_Decision Units_709.mxd 7/22/09

FILE *Fig 3_Decision Unit 1_Sample Locs_709.mxd* *7/22/09*



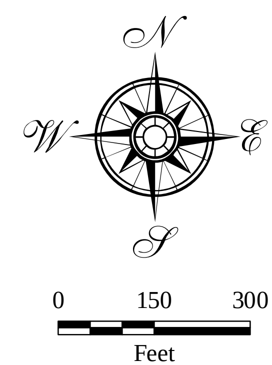
Legend

FMC Property Boundary

Historic RI sample location

Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level

- Comp. Sample 1
- Comp. Sample 2
- Comp. Sample 3
- Comp. Sample 4
- Comp. Sample 5
- Comp. Sample 6
- Comp. Sample 7
- Comp. Sample 8



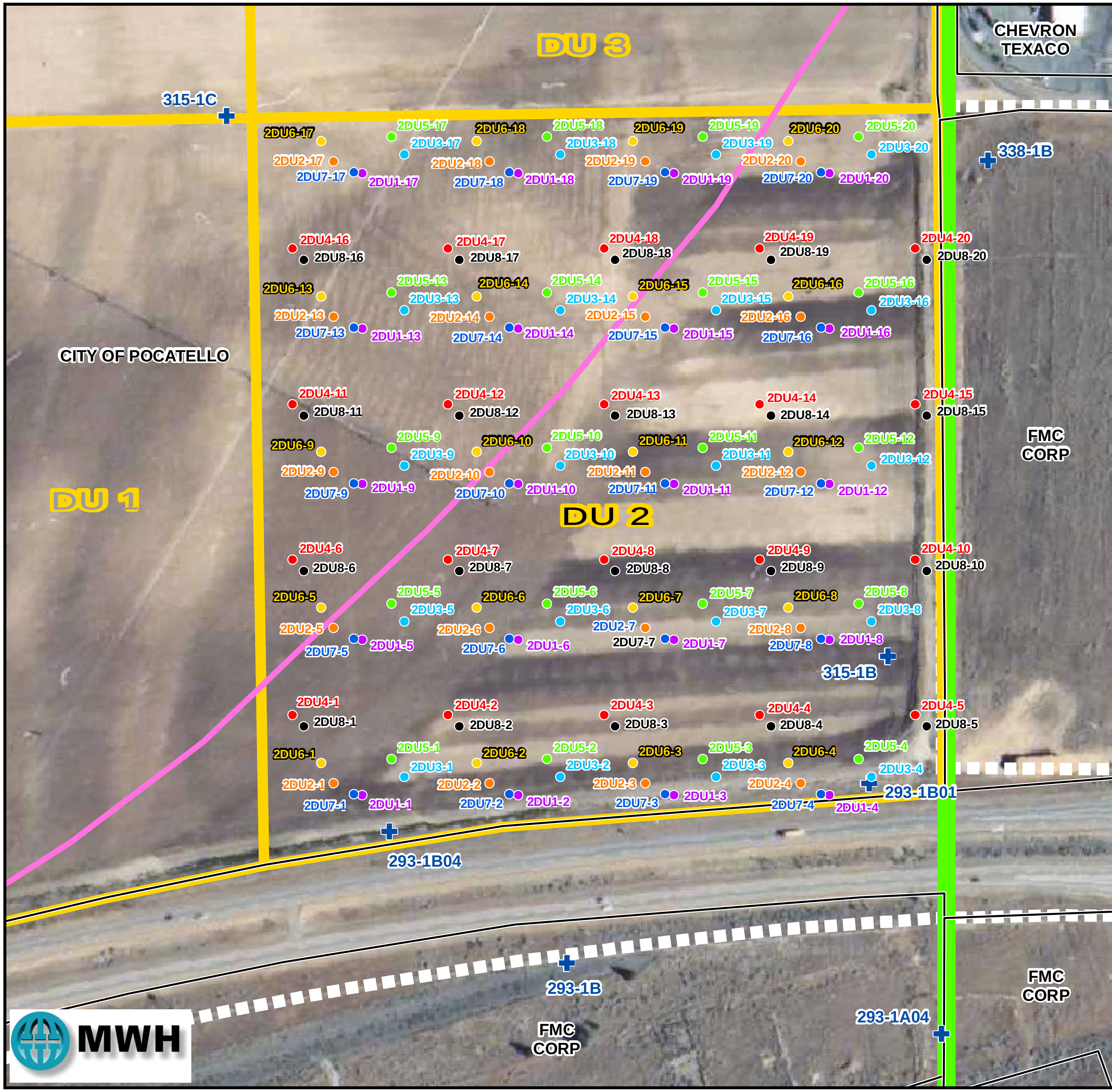
FMC

OFF-PLANT OU WORKPLAN

FIGURE 3

DECISION UNIT 1
SAMPLE LOCATIONS

FILE *Fig 4_Decision Unit 2_Sample Locs_709.mxd* *7/20/09*



Legend

FMC Property Boundary

Historic RI sample location

Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level

- Comp. Sample 1
- Comp. Sample 2
- Comp. Sample 3
- Comp. Sample 4
- Comp. Sample 5
- Comp. Sample 6
- Comp. Sample 7
- Comp. Sample 8

N W E S

0 150 300

Feet

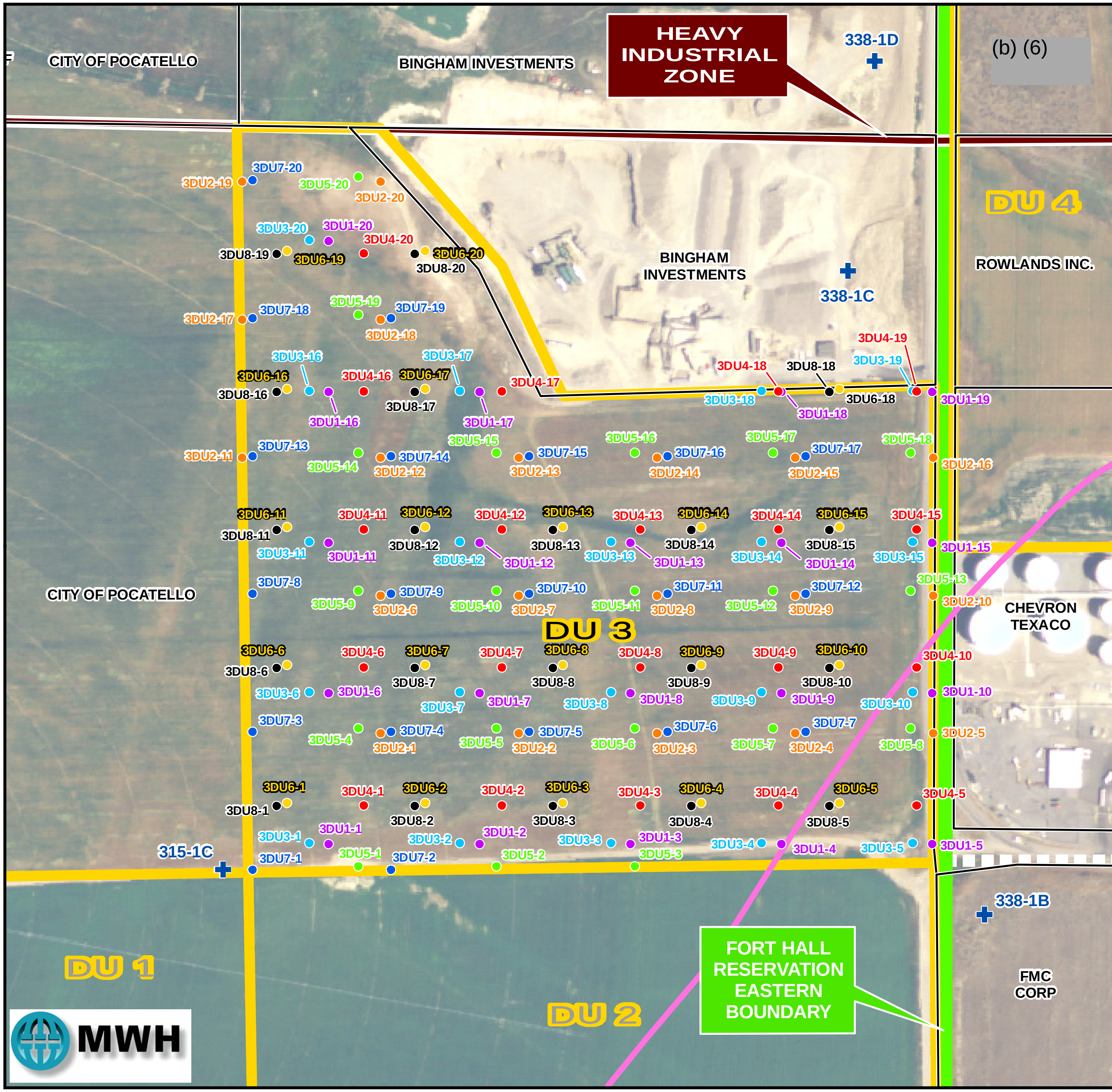
FMC

OFF-PLANT OU WORKPLAN

FIGURE 4

DECISION UNIT 2
SAMPLE LOCATIONS

FILE *Fig 5_Decision Unit 3_Sample Locs_709.mxd* *7/21/09*



Legend

FMC Property Boundary

Historic RI sample location

Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level

- Comp. Sample 1
- Comp. Sample 2
- Comp. Sample 3
- Comp. Sample 4
- Comp. Sample 5
- Comp. Sample 6
- Comp. Sample 7
- Comp. Sample 8

N W E S

0 150 300

Feet

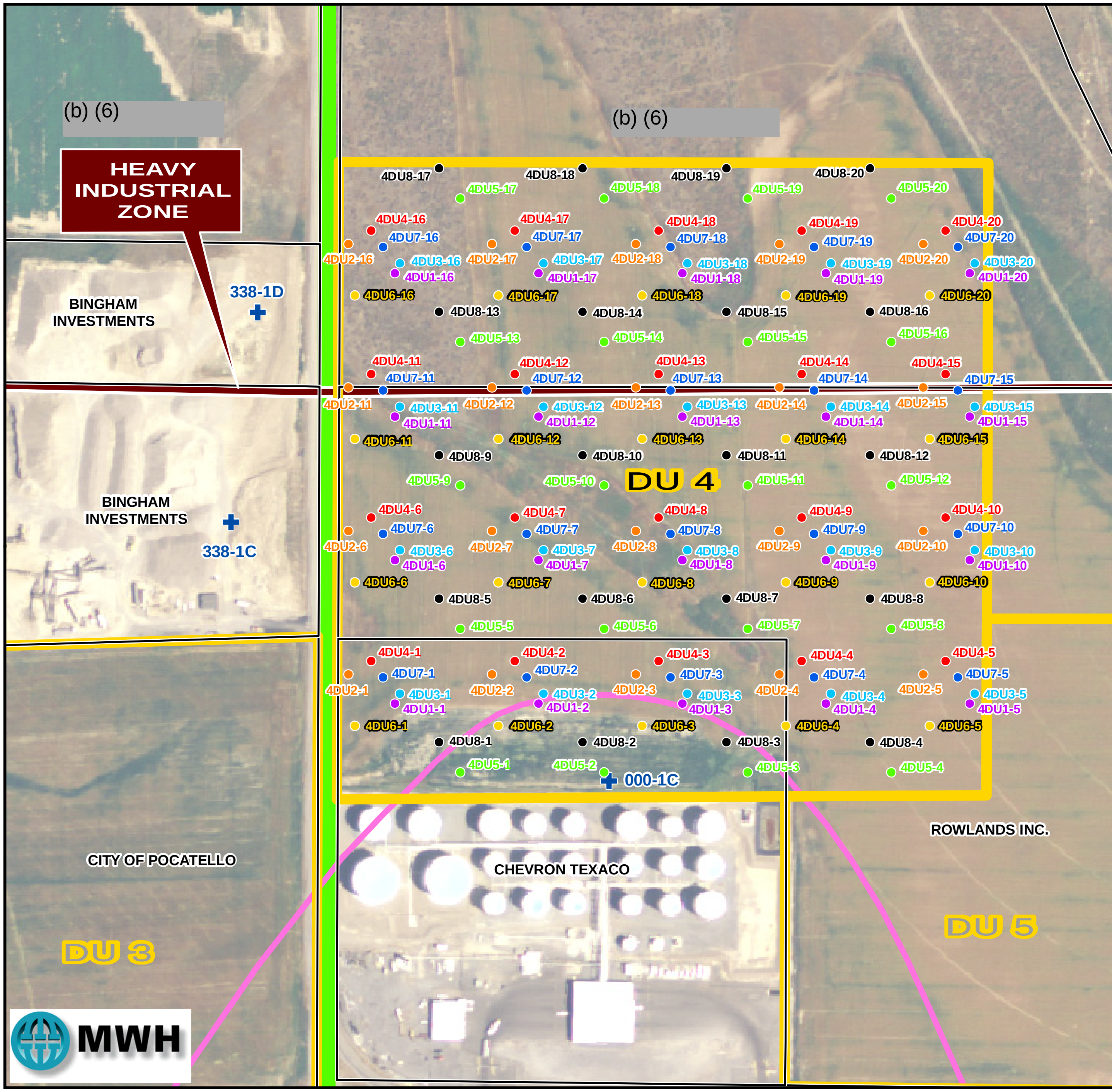
FMC

OFF-PLANT OU WORKPLAN

FIGURE 5

DECISION UNIT 3 SAMPLE LOCATIONS

FILE *Fig 6_Decision Unit 4_Sample Locs_709.mxd* *7/21/09*



Legend

FMC Property Boundary

Historic RI sample location

Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level

- Comp. Sample 1
- Comp. Sample 2
- Comp. Sample 3
- Comp. Sample 4
- Comp. Sample 5
- Comp. Sample 6
- Comp. Sample 7
- Comp. Sample 8

N W E S

0 150 300

Feet

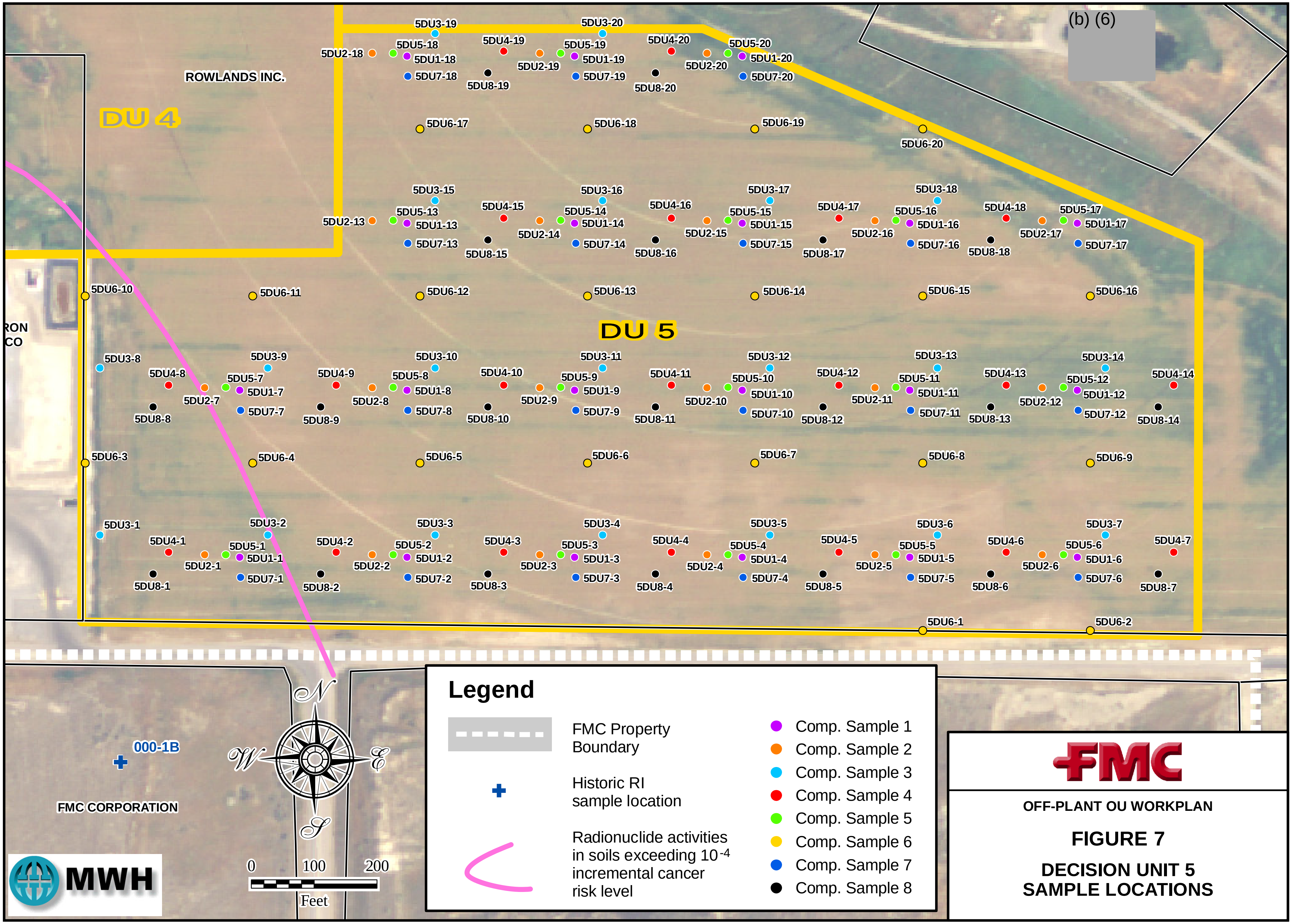
FMC

OFF-PLANT OU WORKPLAN

FIGURE 6

DECISION UNIT 4 SAMPLE LOCATIONS

FILE *Fig 7_Decision Unit 5_Sample Locs_709.mxd* *7/22/09*



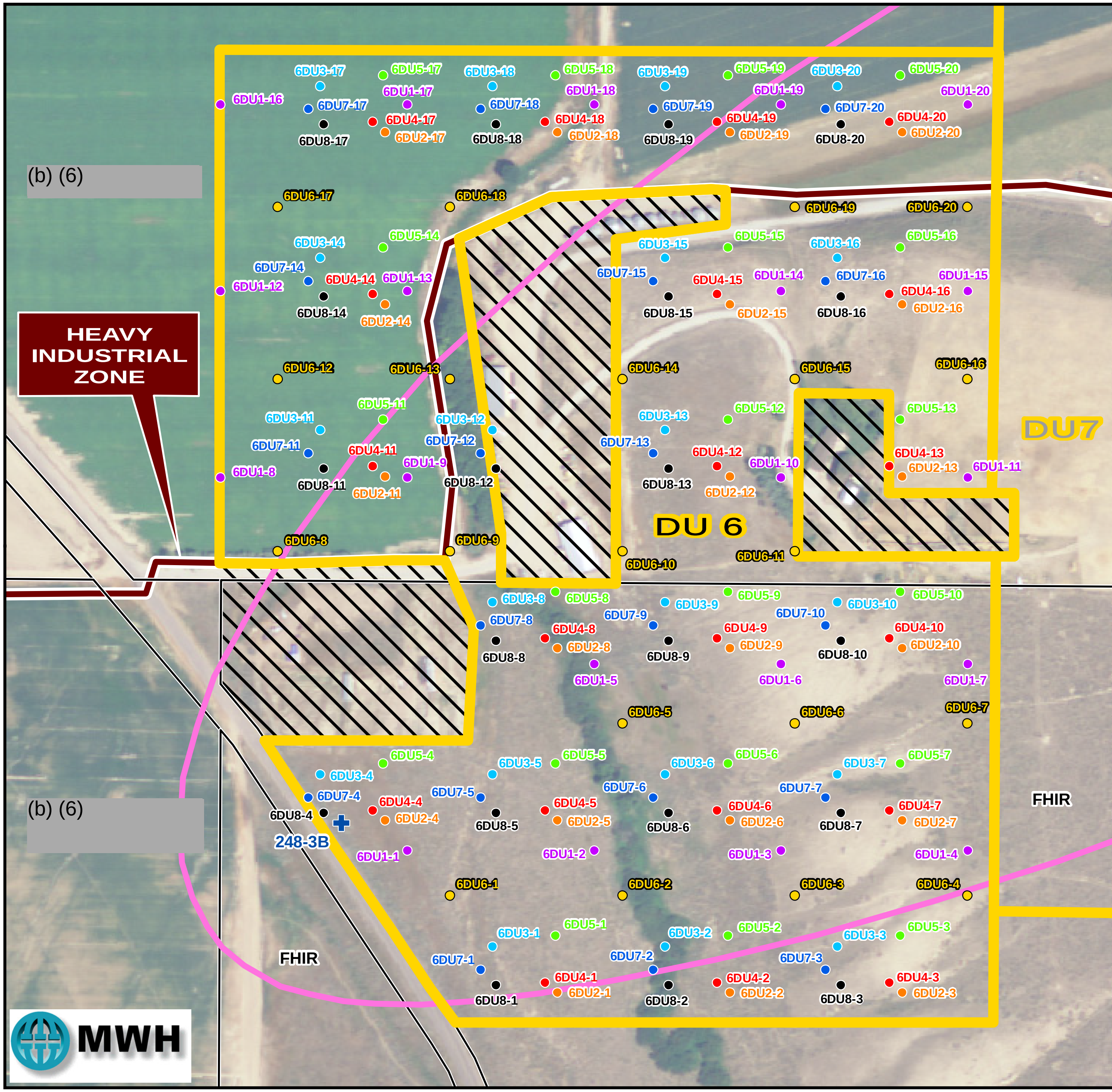
FMC

OFF-PLANT OU WORKPLAN

FIGURE 7

DECISION UNIT 5
SAMPLE LOCATIONS

FILE *Fig 8_Decision Unit 6_Sample Locs_709.mxd* *7/22/09*



Legend

- FMC Property Boundary
- Historic RI sample location
- Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level
- Areas excluded from sampling

Comp. Sample 1	Comp. Sample 5
Comp. Sample 2	Comp. Sample 6
Comp. Sample 3	Comp. Sample 7
Comp. Sample 4	Comp. Sample 8

N E S W

0 150 300

Feet

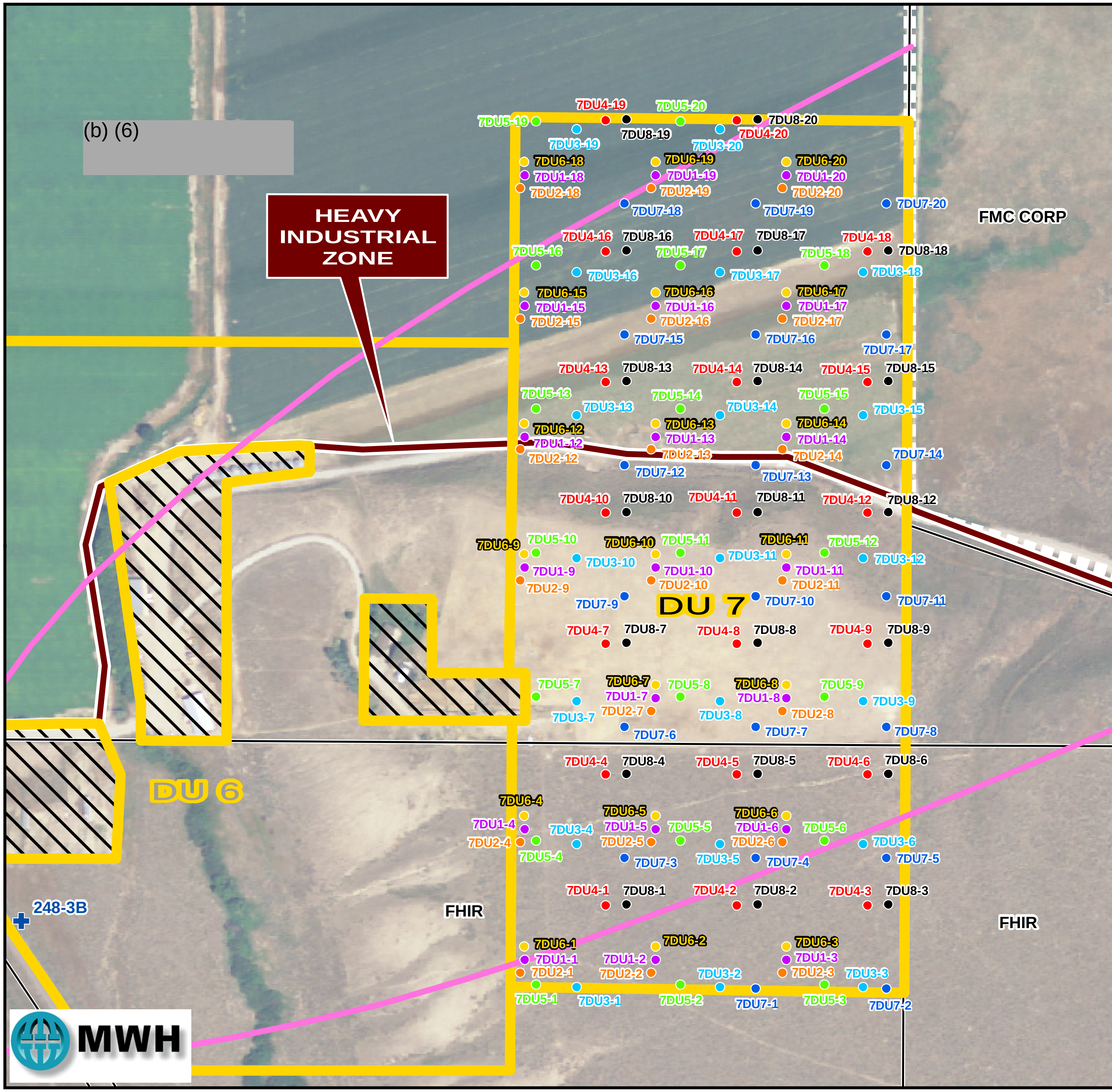
FMC

OFF-PLANT OU WORKPLAN

FIGURE 8

DECISION UNIT 6
SAMPLE LOCATIONS

FILE *Fig 9_Decision Unit 7_Sample Locs_709.mxd* *7/22/09*



Legend

FMC Property Boundary

Historic RI sample location

Radionuclide activities in soils exceeding 10^{-4} incremental cancer risk level

Areas excluded from sampling

- Comp. Sample 1
- Comp. Sample 2
- Comp. Sample 3
- Comp. Sample 4
- Comp. Sample 5
- Comp. Sample 6
- Comp. Sample 7
- Comp. Sample 8

N W E S

0 200 400

Feet

FMC

OFF-PLANT OU WORKPLAN

FIGURE 9

DECISION UNIT 7
SAMPLE LOCATIONS

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE 3

EQUIPMENT DECONTAMINATION

STANDARD OPERATING PROCEDURES 3

EQUIPMENT DECONTAMINATION

TABLE OF CONTENTS

1.0 INTRODUCTION

Decontamination of drilling, sampling equipment, monitoring equipment and support vehicles at the FMC site is a necessary and critical aspect of environmental field investigations. Proper decontamination is a key element in reducing the potential for cross-contamination between samples from different locations, ensuring that samples are representative of the sampled materials, as well as health and safety issues associated with elemental phosphorus. Improper decontamination may result in costly re-collection and re-analysis of samples. All equipment used in the sampling process shall be properly decontaminated prior to the collection of each sample and after completion of sampling activities.

The procedures outlined in this standard operating procedure (SOP) shall be followed during decontamination of field equipment used in the sampling process, including drilling, soil/water sample collection, and monitoring activities. Any deviations from these procedures shall be noted in the field logbooks and approved by the SRI Project Manager, FMC Project Manager and the Quality Manager. Three major categories of field equipment, along with applicable decontamination methods for each, are discussed below.

2.0 DEFINITIONS

Brass Sleeve: Hollow, cylindrical sleeves made of brass and used as liners in split-spoon samplers for collection of undisturbed samples.

Auger Flight: An individual hollow-stem auger section, usually 5 feet in length.

Continuous Core Barrel: 5-foot long steel barrels that can be joined together to allow continuous cores to be collected during a single run.

Drill Pipe: Hollow metal pipe used for drilling, through which soil and groundwater sampling devices can be advanced for sample collection.

Potable Water: A drilling quality water source that can be used for steam cleaning and decontamination water. This source should be sampled at the beginning of each field program to set baseline concentrations.

Distilled Water: Commercially available or laboratory-grade water that has been distilled. Each batch of distilled water should be analyzed to set baseline concentrations. The distilled water will be used as rinse water during the decontamination of tools, sampling equipment and other small items.

Hand Auger: A sampling tool consisting of a metal tube with two sharpened spiral wings at the tip.

Split-Spoon Sampler: A sampling tool consisting of a thick-walled steel tube with a removable head and drive shoe. The steel tube splits open lengthwise when the head and drive shoe are removed.

Scoop: A sampling hand tool consisting of a small shovel- or trowel-shaped blade.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

SRI Project Manager: Selects project-specific drilling and sampling methods, and associated decontamination procedures with input from other key project staff and other personnel that are responsible for project quality control.

Quality Manager: Performs project audits. Ensures project-specific data quality objectives are fulfilled.

SRI Field Team Leader (FTL) and/or Geologist, Hydrogeologist, or Engineer: Implements the field program and supervises other sampling personnel. Ensures that proper decontamination procedures are followed. Prepares daily logs of field activities.

Field Sampling Technician (or other designated personnel): Assists the FTL, geologist, hydrogeologist, or engineer in the implementation of tasks and is responsible for the decontamination of sampling equipment.

4.0 DECONTAMINATION PROCEDURES

A decontamination pad designed to collect the rinsate and any associated soil or chemicals will be established in a location at the FMC site. The decontamination pad will be constructed in an area designated by FMC and will be used for the duration of the project. The decontamination pad will be large enough to accommodate the drill rig and support vehicles present at the site. The rinsate collected from the decontamination pad and from other onsite decontamination activities will be stored in labeled containers until the proper disposal protocol is established pending chemical characterization.

Soil boring drilling and soil sampling procedures require that decontaminated tools be employed in order to prevent cross-contamination. The decontamination procedures described below shall be followed to ensure that only uncontaminated materials will be introduced to the subsurface during drilling and sampling. The equipment decontamination process shall be undertaken before and after each use of the equipment and include either steam cleaning or washing. Steam cleaning of equipment shall be performed at a decontamination facility (e.g., dedicated steam-cleaning pad). The flooring of the decontamination pad shall be impermeable to water and have a sump or low area to collect the rinsate to be transferred into the storage containers.

The precise location of the decontamination facility shall be determined based on such factors as ease of access for personnel and proximity to work site and rinsate storage or staging areas.

4.1 DRILLING AND LARGE EQUIPMENT

The following procedures shall be used for decontamination of large pieces of equipment including drilling equipment and support vehicles. This will include percussion hammer drill pipe, hollow-stem auger flights, drill rods for sampling, the drill rig, support vehicles and other equipment and tools that may come in contact with sampling equipment or that may have possible contamination.

- Steam clean the external surfaces and internal surfaces, as applicable, on equipment using high-pressure hot water from an approved water source. If necessary, scrub using a phosphate-free detergent (e.g., Alconox™), or equivalent laboratory-grade detergent until all visible dirt, grime, grease, oil, loose paint, rust, etc., have been removed.
- Rinse with potable water.

4.2 SOIL AND GROUNDWATER SAMPLING EQUIPMENT

The following procedure will be used to decontaminate sampling equipment such as split-spoon samplers; brass sleeves; continuous core barrels; scoops; hand augers; metal sampling pans; and other sampling equipment and tools that may come into contact with samples.

- Wash and scrub equipment with phosphate-free, laboratory-grade detergent (e.g., Alconox™ or equivalent); steam cleaning may also be performed if possible.
- Double or Triple-rinse with potable water.
- Air dry.
- Store in clean plastic bag or designated casing.

Personnel involved in decontamination activities shall wear appropriate protective clothing as defined in the project-specific health and safety plan.

4.3 GROUNDWATER MONITORING EQUIPMENT

The following procedure shall be used to decontaminate groundwater monitoring devices such as groundwater elevation meters and free product thickness meters. Spray bottles may be used to store and dispense distilled water.

- Wash equipment with laboratory-grade, phosphate-free detergent (e.g., Alconox™ or equivalent) and water, or steam clean.
- Triple-rinse with distilled water.
- Store in clean plastic bag or storage case.

5.0 PROCEDURE FOR OTHER WASTE DISPOSAL

While the decontamination Investigative Derived Waste (IDW) will be evaluated on a case-by-case basis, the general approach to be followed is detailed in SOP-7. Decontamination fluids (typically washwater) will be contained as generated. The washwater will be segregated from solids to the extent practicable (i.e., solids will be allowed to settle out of the washwater on the decontamination containment pad). Washwater will then be containerized to await waste determination. Solids will also be containerized in a separate container to await waste determination.

6.0 REFERENCES

Environmental protection Agency, RCRA Ground-Water Monitoring: Draft Technical Guidance, November 1992. Page 7-17.

STANDARD OPERATING PROCEDURE 4

FIELD DOCUMENTATION

STANDARD OPERATING PROCEDURE 4

FIELD DOCUMENTATION

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1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is a general guidance document for the required documentation to be completed by field personnel during field investigations. Documentation in the form of field logbooks, reports, and forms shall be completed for every activity in the field. Records shall be maintained on a daily basis as the work progresses. All field documentation shall be accurate and legible because it is deliverable to the client as potentially a legal document. Sample field documentation forms are attached.

2.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

SRI Project Manager: Selects project-specific field documentation with input from other key project staff and FMC personnel.

Quality Control Manager: Performs field program audits. Ensures project data quality objectives are fulfilled.

SRI Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Responsible for completing the FTL logbook; Daily Quality Control Reports (DQCRs); documentation concerning supervision of team members; and, the duplication and distribution of applicable records.

Field Technician (or other designated personnel): Assists the FTL and/or field geologist, hydrogeologist, or engineer in the implementation of field tasks and field documentation.

3.0 FIELD DOCUMENTATION PROCEDURES

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the project site. All field documentation shall be accurate, legible and written in indelible black or blue ink. Absolutely no pencils or erasures shall be used. Incorrect entries in the field books, logs, or on forms that need to be deleted shall be crossed out with one line, initialed, and dated. Skipped pages or blank sections at the end of a page shall be crossed out with an "X" covering the entire page or blank section; "No Further Entries," initials, and date shall be written by the person crossing out the blank section or page. The responsible field team member shall write his/her signature, date, and time after the day's last entry.

To further assist in the organization of the field books, logs, or forms, the date shall be recorded on top of each page along with the significant activity description (e.g., surface sample or soil boring number). All original field documentation shall be retained in the project files. The descriptions of field data documentation given below serve as an outline; individual activities may vary in documentation requirements.

3.1 FIELD LOGBOOKS

The field logbook shall be a bound, weatherproof book with numbered pages, and shall serve primarily as a daily log of the activities carried out during the fieldwork. All entries shall be made in indelible black or blue ink. A field logbook shall be completed for each operation undertaken during the field tasks, such as field team leader notes, drilling, sampling, and site visitors. The logbook shall serve as a diary of the events of the day.

Field activities vary from project to project; however, the concept and general information that shall be recorded are similar. A detailed description of two basic example logbooks, suitable for documentation of field activities, is given below. These field logbooks include the FTL logbook and the field geologist/sampling team logbook.

FTL Logbook: The FTL's responsibilities include the general supervision, support, assistance, and coordination of the various field activities. As a result, a large portion of the FTL's day is spent rotating between operations in a supervisory mode. Records of the FTL's activities, as well as a summary of the field team's activities, shall be maintained in a logbook. The FTL's logbook shall be used to fill out daily/weekly reports and daily quality control reports (DQCRs), and therefore, shall contain all required information. A sample DQCR form is included in Attachment A. Items to be documented include:

- Record of tailgate meetings
- Personnel and subcontractors on job site and time spent on the site
- Field operations and personnel assigned to these activities
- Site visitors
- Log of FTL's activities: time spent supervising each operation and summary of daily operations as provided by field team members
- Problems encountered and related corrective actions
- Deviations from the sampling plan and reasons for the deviations
- Records of communications; discussions of job-related activities with the client, subcontractor, field team members, and project manager
- Information on addresses and contacts
- Record of invoices signed and other billing information
- Field observations

Field Geologist/Sampling Team Logbook: The field geologist or sampling team leader shall be responsible for recording the following information in a logbook:

- Health and Safety Activities
  - Calibration records for health and safety equipment (e.g., type of PID, calibration gas used, associated readings, noise dosimeters, etc.)
  - Personnel contamination prevention and decontamination procedures

  - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Site name and well or soil boring number
- Drilling activities
  - Sample location (sketch)
  - Drilling method and equipment used
  - Borehole diameter
  - Drill cuttings disposal/containerization (e.g., number of drums, roll-off bins, etc.)
  - Type and amount of drilling fluids used (e.g., mud, water, etc.)
  - Depth and time at which first groundwater was encountered The absence of water in the boring should also be noted.
  - Total drilling depth of well or soil boring
  - Type and amount of material used to abandon soil borings
  - Time and date of drilling, completion, and backfilling
  - Name of drilling company, driller, and helpers
- Sampling
  - Date and time of sample collection
  - Sample interval
  - Number of samples collected
  - Analyses to be performed on collected samples
- Disposal of contaminated wastes (e.g., PPE, paper towels, Visqueen, etc.)
- Field observations
- Problems encountered and corrective action taken
- Deviations from the sampling plan and reason for the deviations
- Site visitors

3.2 FIELD FORMS

Boring Logs: The preparation of boring logs shall be the responsibility of the field team members assigned to the drill rig. A detailed description of soil classification procedures is included in SOP-8. An example of the Soil Boring Log form is included in Attachment A. While a soil boring log will be completed for each soil boring drilled at the site some soil borings will not be continuously logged due to the proximity to other borings. After the geology and interface between native and fill material has been determined based on field observations, a determination will be made on the depth where other near-by soil borings will be logged. The specific format is dictated by project requirements; however, the following information shall be recorded on the soil boring log.

- Project name, project number, and site name
- Name of drilling company
- Soil boring ID and location (sketch)
- Drilling and backfilling dates and times
- Total depth of completed soil boring
- Name of the logger
- Description of unconsolidated materials
  - Lithologic description
  - Descriptive Unified Soil Classifications System (USCS) classification
  - USCS symbol
  - Descriptive observations including gradation, plasticity, moisture content, cementation, grain size, angularity of coarse particles, odor, fractures, visible contamination, specific mineralogy, bedding, PID readings, etc.)
- Color (use appropriate soil color chart [e.g., Munsel Color Chart])
- Description of consolidated materials
  - Geologic rock description
  - Rock type
  - Descriptive observations including relative hardness, density, texture, weathering, bedding, structures (e.g., fractures, joints, bedding, etc.), odor, visible contamination, PID readings and stratigraphic/lithologic changes
- Depth intervals of sample and the amount of sample recovered

- Blow counts
- Depth intervals from which samples are retained
- Analyses to be performed on collected samples
- Depth at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted
- Use of drilling fluids
- Evidence of contamination

3.3 PHOTOLOGS

Photologs are often used in the field to document site conditions (e.g., trenches and excavations, significant lithologic changes during soil logging and classification). While photographs may not always be required, they shall be used wherever applicable to show existing site conditions at a particular time and stage of the investigation or related site activity. Photolog information shall include:

- Photographer's names
- Date and time of photo
- Direction of the photo
- Prevailing weather conditions at the time the photo was taken
- Description of what the photo is intended to show
- Borehole identification number
- Interval

An engineer's scale or tape shall be included in any photographs taken of soil core. Any wasted frames or images in a roll of film or sequence of digital images shall be so noted in the field logbook.

3.4 LABELS AND CHAIN-OF-CUSTODY RECORDS

Documentation to be made during sampling activities includes sample labels, sample seals, Chain-of-Custody (COC) records, and sample register.

Sample Labels: A sample label shall be affixed to all sample containers. All samples will be labeled in a clear, precise way for proper identification in the field and for tracking in the laboratory. The samples will have identifiable and unique numbers. At a minimum, the sample labels will contain the following information:

- facility name
- sample number
- sample depth
- date of collection
- time of collection
- analytical parameter(s)
- method of sample preservation

The sample information (e.g., date, time, location ID, etc.) shall be written in indelible ink.

Custody Seals: Custody seals will be used to preserve the integrity of each sample container and cooler from the time the sample is collected until it is opened by the laboratory. Custody seals will be placed on each sample container after collection such that it must be broken to open the container. Two or more custody seals will be signed, dated, and placed on the front and back of the sample cooler prior to transport.

Chain-of-Custody Records: Chain-of-Custody (COC) procedures allow for the tracking of possession and handling of individual samples from the time of field collection through to laboratory analysis. Documentation of custody is accomplished through a COC record that lists each sample and the individuals responsible for sample collection, shipment, and receipt. A COC record is used to record the samples taken and the analyses requested. Each form will include the following information:

- sample number
- date of collection
- time of collection
- sample depth
- analytical parameter
- method of sample preservation
- number of sample containers
- shipping arrangements and airbill number, as applicable
- recipient laboratories
- signatures of parties relinquishing and receiving the sample at each transfer point

Whenever a change of custody takes place, both parties will sign and date the chain-of-custody form, with the relinquishing person retaining a copy of the form. The party that accepts custody will inspect the custody form and all accompanying documentation to ensure that the information is complete and accurate. Any discrepancies will be noted on the chain-of-custody form. Shipping receipts shall be signed and filed as evidence of custody transfer between field sampler(s), courier, and laboratory.

5.0 REFERENCES

RCRA Ground-Water Monitoring: Draft Technical Guidance, November 1992.

STANDARD OPERATING PROCEDURE 12

SAMPLE HANDLING AND SHIPPING

STANDARD OPERATING PROCEDURE 12

SAMPLE HANDLING AND SHIPPING

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1.0 INTRODUCTION

This standard operating procedure (SOP) describes the requirements for sample identification, chain-of-custody (COC) documentation, and sample handling, storage and shipping. The purpose of this SOP is to define sample management activities as performed from the time of sample collection to the time they are received by the laboratory.

2.0 DEFINITIONS

Chain-of-Custody: An accurate written record of the possession of each sample from the time of collection in the field to the time the sample is received by the designated analytical laboratory.

Sample: Physical evidence collected for environmental measuring and monitoring. For the purposes of this SOP, sample is restricted to solid, aqueous, air, or waste matrices. This SOP does not cover samples collected for lithologic description nor does it include remote sensing imagery or photographs (refer to SOP-4 for field documentation procedures).

Sampler: The individual who collects environmental samples during fieldwork.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

SRI Project Manager: The Project Manager is responsible for ensuring that the requirements for sample management are included in the appropriate project plans. The

Project Manager is responsible for coordinating sample management efforts with input from other key project staff and MWH personnel.

Quality Manager: Performs project audits. Ensures project-specific data quality objectives are fulfilled.

SRI Field Team Leader and/or Field Hydrogeologist, Geologist or Engineer: Conducts the procedures described herein and, if applicable, the requirements of the project plan. Responsible for reviewing documentation developed from sample management to determine compliance with this SOP and project quality control (QC) requirements. Prepares daily logs of field activities.

Field Technician: Responsible for sample collection, documentation, packaging, and shipping. Assists the FTL and/or geologist, hydrogeologist, or engineer in the implementation of tasks.

4.0 PROCEDURES

4.1 APPLICABILITY

The sample handling and shipping procedures described in this SOP apply to all work conducted at the FMC Plant OU. The information in this SOP may be used by direct reference or incorporated into project-specific plans. Deviations or modifications to procedures addressed herein must be brought to the attention of, and approved by, the FMC Project Manager, SRI Project Manager and the Quality Manager.

Based on visual confirmation, it is not anticipated that elemental phosphorus will be present in samples collected for shipment. However, in order to ensure the health and safety of all project personnel, specific procedures for shipping, handling, and analyzing the samples will be followed. Health and safety precautions will take precedence over approved methodologies that might result in the exposure of elemental phosphorus to oxygen.

4.2 SAMPLE MANAGEMENT

Sample Containers: The sample containers to be used shall be dependent on the sample matrix and analyses desired. Sample containers shall be filled with adequate headspace (approximately 10 percent) for safe handling upon opening, except containers for volatile organic compound (VOC) analyses, that require no headspace. Once opened, the containers shall be used immediately. If the container is used for any reason in the field (e.g., screening) and not sent to the laboratory for analysis, it shall be discarded. Prior to discarding the contents of the used container and the container, disposal requirements shall be evaluated. When storing before and after sampling, the containers shall remain separate from solvents and other volatile organic materials. Sample containers with preservatives added by the laboratory shall not be used if held for an extended period on the job site or exposed to extreme heat conditions. Containers shall be kept in a cool, dry place.

Sample Label. A sample label shall be affixed to all sample containers. Labels provided by the laboratory or another supplier may be used, and at a minimum shall include the following information:

- Client name, project title, or project location (sufficiently specific for data management)
- Sample location
- Sample identification number
- Date and time of sample collection
- Type of sample (grab or composite)
- Initials of sampler
- Preservative used
- Analyte(s) of interest.

After labeling, each sample shall be refrigerated or placed in a cooler containing wet ice to reduce sample temperature to approximately 4 degrees Celsius (°C).

Custody Seals. Custody seals will be used to preserve the integrity of each sample container and cooler from the time the sample is collected until it is opened by the laboratory. Custody seals will be placed on each sample container after collection such that it must be broken to open the container. Two or more custody seals will be signed, dated, and placed on the front and back of the sample cooler prior to transport.

Chain-of-Custody: Chain-of-custody (COC) procedures require a written record of the possession of individual samples from the time of collection through laboratory analyses. A sample is considered to be in custody if it is:

- In a person's possession
- In view after being in physical possession
- In a secured condition after having been in physical custody
- In a designated secure area, restricted to authorized personnel

The COC record shall be used to document the samples taken and the analyses requested. Information recorded by field personnel on the COC record shall include the following:

- Client name
- Project name
- Project location
- Sampling location
- Signature of sampler(s)
- Sample identification number
- Date and time of collection
- Sample designation (grab or composite)
- Sample matrix
- Signature of individuals involved in custody transfer (including date and time of transfer)
- Airbill number (if appropriate)
- Type of analysis and laboratory method number
- Any comments regarding individual samples (e.g., organic vapor meter readings, special instructions).

COC records shall be placed in a waterproof plastic bag (e.g., Ziploc®), taped to the inside lid of the cooler or placed at the top of the cooler, and transported with the samples. When the sample(s) are transferred, both the receiving and relinquishing individuals shall sign the record. Fedex hand carry shall serve as custody transfer between the field sampler and courier, as well as courier and laboratory. If a carrier service is used to ship the samples (e.g., Federal Express, etc.), custody records shall remain with the sampler until it is relinquished to the laboratory. The sampler shall retain copies of the COC record and airbill.

Sample Register/Sample Tracking: The sample register is a logbook field form or electronic database used to document which samples were collected on a particular day. The sample register is also used as the key to correlate field samples with duplicate samples. Information recorded in the sample register shall include the following:

- Client name
- Project name and location
- Job number
- Date and time of collection
- Sample identification number
- Sample designation (e.g., grab or composite, etc.)
- Sample matrix (e.g., soil, groundwater, etc.)
- Number and type of bottles
- Type of analysis
- Sample destination
- Sampler's initials.

A sample tracking database, which includes the above information, may be substituted for a handwritten sample register. However, a hard copy of each day's sampling activities shall be maintained in the field files or field logbook as discussed in SOP-4 (Field Documentation).

Sample Preservation/Storage: The requirements for sample preservation are dependent on the desired analyses and the sample matrix. Unless otherwise specified by the project plan, sample preservation requirements shall be observed.

4.3 SAMPLE SHIPPING

Procedures for packaging and transporting samples to the laboratory are based on the actual chemical, physical, and hazard properties of the material. The procedures may also be based on an estimation of contaminant concentrations/properties in the samples to be shipped. Samples shall be identified as either environmental samples, excepted quantities samples, limited quantities samples, or standard hazardous materials. Environmental samples are defined as solid or liquid samples collected for chemical or geotechnical analysis. These samples are used to support remedial investigation, feasibility studies, treatability studies, remediation design and performance assessment, waste characterization, etc. Excepted quantities involve the shipment of a few milliliters of either an acid or base preservative in an otherwise empty sample container. Limited quantities are restricted amounts of hazardous materials that may be shipped in generic, sturdy containers. Standard hazardous material shipments require the use of stamped/certified containers. All samples shall be packaged and shipped or hand delivered to the laboratories the same day of sample collection, unless otherwise specified in the project-specific work plans.

The following paragraphs describe standard shipping procedures for different types of samples. Any exceptions to these procedures shall be defined in the project-specific work plan. It is the responsibility of the sampler to understand U.S. Department of Transportation (DOT) requirements and limitations associated with the shipment of all types of samples.

Sample Shipping via Commercial Carrier:

Aqueous or Solid Samples: Samples shall be packaged and shipped to the laboratories the same day of sample collection, unless otherwise specified in the project work plans and depending on holding time requirements for individual samples. For aqueous or solid samples that are shipped to the Contract Laboratory via a commercial carrier the following procedures apply:

- Sample labels shall be completed and attached to sample.
- The samples shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler.
- Ice in double Ziploc® bags (to prevent leakage) shall be placed around, among, and on top of the sample bottles. Enough ice shall be used so that the samples shall be chilled and maintained at 4°C ± 2°C during transport to the laboratory. Dry ice shall not be used. In addition, experience has shown that blue ice is inadequate.
- To prevent the sample containers from shifting inside the cooler, the remaining space in the cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers.
- The original copy of the completed COC form shall be placed in a waterproof plastic bag and taped to the inside of the cooler lid or placed at the top of the cooler.
- The lid shall be secured by wrapping strapping tape completely around the cooler in two locations.
- Custody seals shall be used on each shipping container to ensure custody. Custody seals used during the course of the project shall consist of security tape with the date and initials of the sampler.
- A copy of the COC record and the signed air bill shall be retained for the project files.

Air Samples: If transported by a commercial carrier, air, soil vapor, or treatment system off-gas samples shall be packaged and shipped to the Contract Laboratory using the following procedures:

- A completed sample tag shall be attached with a wire to the PUF/XAD-2 Cartridge, Summa® canister or Tedlar™ bag for each investigative or quality control sample. All entries shall be made using indelible ink, or pre-printed individual labels. Any errors shall be corrected by drawing a single line through the incorrect entry, entering the correct information, and then initialing and dating the change. The tag shall include the field sample number, location (if not encoded in the sample ID), date and time of sample collection, and type of analysis. There shall also be a space available for entry of the lab sample ID number.

- The samples in PUF/XAD-2 Cartridge or Tedlar™ bags shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler. The Summa® canisters shall be placed in their original shipping container.
- To prevent the PUF/XAD-2 Cartridge or Tedlar™ bags from shifting inside the cooler, the cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers.
- Ice in double Ziploc® bags (to prevent leakage) shall be placed around, among, and on top of the PUF/XAD-2 Cartridges. There are no temperature criteria for samples in Tedlar™ bags. Enough ice shall be used so that the samples shall be chilled and maintained at $4 \pm 2°C$ during transport to the laboratory.
- The original copy of the completed COC form shall be placed in a waterproof plastic bag and either taped to the inside of the cooler lid or placed at the top of the cooler or in the Summa® canister packaging box.
- The coolers or Summa® canister packaging box shall be secured by wrapping strapping tape completely around the containers in two locations.
- Custody seals shall be used on each shipping container to ensure custody. Custody seals used during the course of the project shall consist of security tape with the date and initials of the sampler. The custody seal shall be placed on the outside of the container used for shipping.
- A copy of the COC record and the signed air bill shall be retained for the project files.

Hand-Delivered Samples:

Aqueous or Solid Samples: For aqueous or solid samples that will be hand carried to the Contract Laboratory, the following procedures apply:

- Sample labels shall be completed and attached to sample.

- The samples shall be placed upright in a waterproof metal (or equivalent strength plastic) ice chest or cooler.
- Ice in double Ziploc® bags (to prevent leakage) shall be placed around, among, and on top of the sample bottles. Enough ice shall be used so that the samples will be chilled during transport to the laboratory.
- To prevent the sample containers from shifting inside the cooler, the remaining space in cooler shall be filled with inert cushioning material, such as shipping peanuts, additional bubble pack, or cardboard dividers.
- The original copy of the completed COC form shall accompany the samples to the laboratory.
- A copy of the COC record shall be retained for the project files.

Excepted Quantities: Usually, corrosive preservatives (e.g., hydrochloric acid, sulfuric acid, nitric acid, or sodium hydroxide) are added to otherwise empty sample bottles by the analytical laboratory prior to shipment to field sites. However, if there is an occasion whereby personnel are required to ship bottles with these undiluted acids or bases, the containers shall be shipped in the following manner:

1. Each individual sample container shall have not more than 30 milliliters of preservative.
2. Collectively, the preservative in these individual containers shall not exceed a volume of 500 milliliters in the same outer box or package.
3. Despite the small quantities, only chemically compatible material may be placed in the same outer box, (e.g., sodium hydroxide, a base, must be packaged separately from the acids).
4. Federal Express will transport nitric acid only in concentrations of 40 percent or less.
5. A "Dangerous Goods in Excepted Quantities" label shall be affixed to the outside of the outer box or container. Information required on the label includes:

    - Signature of Shipper
    - Title of Shipper

- Date
- Name and Address of Shipper
- Check of Applicable Hazard Class
- Listing of UN Numbers for Materials in Hazard Classes

Limited Quantities: Occasionally, it may become necessary to ship known hazardous materials, such as pure or floating product. DOT regulations permit the shipment of many hazardous materials in "sturdy" packages, such as an ice chest or cardboard box (not a specially constructed and certified container), provided the following conditions are met:

1. Each sample bottle is placed in a plastic bag, and the bag is sealed. Each VOC vial is wrapped in a paper towel, and the vials are placed in a sealable bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security.
2. Another alternative is each bottle is placed in a separate paint can, the paint can is filled with vermiculite, and the lid is affixed to the can. The lid must be sealed with metal clips, filament, or evidence tape. If clips are used, the manufacturer typically recommends six clips.
3. The cans are placed upright in a cooler that has had the drain plug taped shut inside and outside, and the cooler is lined with a large plastic bag. Approximately 1 inch of packing material, such as vermiculite or other type adsorbent sufficient to retain any liquid that may be spilled, is placed in the bottom of the liner. Three sizes of paint cans are used: pint, half-gallon, and gallon. The pint or half-gallon paint cans may be stored on top of each other; however, the gallon cans are too high to stack. The cooler shall be filled with additional packing material, and the liner shall be taped shut. Only containers having chemically compatible material may be packaged in each cooler or other outer container.
4. The COC record is sealed inside a plastic bag and placed inside the cooler. The sampler retains one copy of the COC record. The laboratory shall be notified if the sample is suspected of containing any substance for which the laboratory personnel should take safety precautions.

5. The cooler is shut and sealed with strapping tape (filament type) around both ends. Two signed custody seals shall be placed on the cooler, one on the front and one on the back. Additional seals may be used if the sampler and/or shipper consider more seals to be necessary. Wide, clear tape shall be placed over the seals to ensure against accidental breakage.
6. The following markings are placed on the side of the cooler:

   - Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA Dangerous Goods Regulations [DGR])
   - UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)
   - Shipper's name and address
   - Consignee's name and address
   - The words "LIMITED QUANTITY"
   - Hazard Labels (Column E, List of Dangerous Goods, Section 4, IATA DGR)
   - Two Orientation (Arrow) labels placed on opposite sides.

7. The Airbill/Declaration of Dangerous Goods form is completed as follows:

   - Shipper's name and address
   - Consignee's name and address
   - Services, Delivery & Special Handling Instructions
   - Cross out "Cargo Aircraft Only" in the Transport Details Box
   - Cross out "Radioactive" under Shipment Type
   - Nature and Quantity of Dangerous Goods

     - Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA DGR)
     - Class or Division (Column C, List of Dangerous Goods, Section 4, IATA DGR)
     - UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)

- Packing Group (Column F, List of Dangerous Goods, Section 4, IATA DGR)
- Subsidiary Risk, if any (Column D, List of Dangerous Goods, Section 4, IATA DGR)
- Quantity and type of packing (number and type of containers: for example, "3 plastic boxes", and the quantity per container, "2 L", is noted as "3 Plastic boxes X 2 L" This refers to 3 plastic boxes (coolers are referred to as plastic boxes) with 2 liters in each box.
- Packing Instructions (Column G, List of Dangerous Goods, Section 4, IATA DGR).
- Note: Only those Packing Instructions in Column G that begin with the letter "Y" may be used. These refer specifically to the Limited Quantity provisions.
- Authorization (Write in the words Limited Quantity)
- Emergency Telephone Number (List 800-535-5053. This is the number for INFOTRAC.)
- Printed Name and Title, Place and Date, Signature.

Standard Hazardous Materials: Shipment of standard hazardous materials presents the most difficulty and expense. However, there may be occasion whereby a hazardous material cannot be shipped under the Limited Quantity provisions.

In such cases, the general instructions noted above but for non-Limited Quantity materials shall apply, with one important difference: standard hazardous materials shipment requires the use of certified outer shipping containers. These containers have undergone rigid testing and are, therefore, designated by a "UN" stamp on the outside, usually along the bottom of a container's side. The UN stamp is also accompanied by codes specifying container type, packing group rating, gross mass, density, test pressure, year of manufacturer, state of manufacturer, and manufacturer code name.

4.4 HOLDING TIMES

The holding times for samples will depend on the analysis and the sample matrix.

4.5 TRAINING

The U.S. DOT requires that all employees involved in any aspect of hazardous materials transport (e.g. shipping, transport, receipt, preparing documents, and etc.) receive training every three years. Contractors working on FMC Plant OU shall be responsible for providing training for their own employees.

4.6 ADDITIONAL INFORMATION

General questions regarding this SOP or inquiries on the safe transport of other specific chemicals or by other carriers should be referred to the SRI/MWH Project Manager.

5.0 REFERENCES

Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, Draft, Appendix D, April 1980.

STANDARD OPERATING PROCEDURE 15

SURFACE SOIL SAMPLING

STANDARD OPERATING PROCEDURE 15

SURFACE SOIL SAMPLING

TABLE OF CONTENTS

1.0 INTRODUCTION

This standard operating procedure (SOP) describes methods and equipment commonly used for collecting environmental surface soil samples for chemical and geotechnical analyses. The information presented in this SOP is generally applicable to the collection of all surface soil samples, except where the analyte(s) may interact with the sampling equipment. This SOP defines sample collection procedures using hand augers, shovels/trowels, and soil core samplers. Procedures for collecting subsurface soil samples are outlined in SOP-14.

This document focuses on methods and equipment that are readily available and typically applied in collecting surface soil samples. It is not intended to provide an all-inclusive discussion of sample collection methods. Specific sampling problems may require the adaptation of existing equipment or design of new equipment. Such innovations shall be clearly described in the project-specific sampling plan and approved by the FMC Project Manager, SRI Project Manager, and the Quality Manager.

2.0 DEFINITIONS

Environmental Sample: A solid sample collected for chemical or geotechnical analysis. These samples are used to support remedial investigation, feasibility studies, treatability studies, remediation design and performance assessment, waste characterization, etc.

Hand Auger: A sampling tool consisting of a stainless steel tube with two sharpened spiral wings at the tip.

Shovel/Trowel: A sampling device consisting of a stainless steel spade attached to a handle.

Soil Core Sampler: A variable diameter stainless steel tube that can be attached to a hammer for driving into surface soil. The tube can also be fitted with retaining liners.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

SRI Project Manager: Selects site-specific sampling methods, sample locations, and constituents to be analyzed with input from other key project staff.

Quality Manager: Overall management and responsibility for the sampling methods, sample locations, and constituents to be analyzed with input from other key project staff and FMC personnel.

SRI Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Implements the sampling program and supervises other sampling personnel. Prepares daily logs of field activities.

Sampling Technician (or other designated personnel): Assists the FTL, geologist, hydrogeologist, or engineer in the implementation of tasks. Performs the actual sample collection, packaging, and documentation (e.g., sample label and log sheet, chain-of-custody record, etc).

4.0 SURFACE SOIL SAMPLING

4.1 BACKGROUND

Surface soil samples are typically collected from the ground surface to 6 inches below ground surface. Samples collected from greater than 6 inches below ground surface are referred to as subsurface soil samples. Surface soil samples may be collected as grab samples or as composite samples. The sample method is determined based on the physical characteristics of the site and matrix.

- Grab sample: A sample taken from a particular location. Grab samples are useful in determining discrete concentrations, but also allow evaluation of spatial variability when multiple samples are collected.
- Composite sample: A number of samples that are individually collected then combined (homogenized) into a single sample for subsequent analysis. Composite samples are useful when averaged or normalized concentration estimates of a waste stream or an area are desired.

4.2 SAMPLING PROGRAM OBJECTIVES

The objective of surface soil sampling is to characterize chemical properties of the soil, and possibly identify potential sources of contaminants. Sampling objectives are typically diverse and dependent on the nature of the project data quality objectives. Details pertaining to sample locations, number of samples, and type of analyses required, shall be presented in project-specific work plans.

4.3 SAMPLING EQUIPMENT AND TECHNIQUES

A surface soil sample may consist of a single scoop or core, or the sample may be a composite of several individual samples. Surface soil samples shall be obtained using hand augers, shovels/trowels, or soil core samplers.

Hand Auger: A hand auger consists of a stainless steel tube with two sharpened spiral wings at the tip. The auger typically cuts a 2-inch to 3-inch diameter boring. Because the auger is hand-driven, penetration in dense or gravelly soil may be difficult. For surface soil sample collection, the procedures outlined below shall be followed. Procedures for sample handling and shipping are presented in SOP-12.

1. Advance the auger by hand into the soil, to the desired depth (6 inches or less for surface soil samples), by turning in a clockwise direction with downward force applied.
2. Retrieve the auger to the surface, preferably without rotation.
3. Fill sample jars using decontaminated stainless steel spatulas or spoons. Collect samples for volatile organic compound (VOC) analysis first and immediately containerize to minimize VOC loss. Samples for VOC analysis require special handling (refer to SOP-13 for details).
4. Place samples for other analyses into a stainless steel bowl for homogenization following the methods described in SOP-16. Prior to homogenization, remove twigs, rocks, leaves and other undesirable debris if they are not considered part of the sample.

Shovel/Trowel: Various shovel/trowel designs and sizes are commercially available for a variety of sampling applications. These devices are hand-driven and are typically used for sampling relatively soft, unconsolidated soil deposits. Some designs (e.g., the Sharpshooter™) can be driven into hard, rocky soil by opening a deep, narrow hole. Shovels or trowels used for surface soil sampling shall be made of stainless steel. The procedures outlined below shall be followed while collecting samples with shovels or trowels. Procedures for sample handling and shipping are presented in SOP-12.

1. Drive the shovel/trowel into the soil. If the soil is dense, use your body weight to drive the shovel by stepping on the rear edge of the shovel.
2. Retrieve the shovel/trowel to the surface.
3. Fill sample jars using decontaminated stainless steel spatulas or spoons. Collect samples for VOC analysis first and immediately containerize to minimize VOC loss. Samples for VOC analysis require special handling (refer to SOP-13 for details).
4. Place sample for remaining analyses into a stainless steel bowl for homogenization following the methods described in SOP-16. Prior to homogenization, remove twigs, rocks, leaves and other undesirable debris if they are not considered part of the sample.

Soil Core Sampler: Soil core samplers consist of variable diameter (commonly 1-2 inches), stainless-steel tubes that can be attached to a hammer using a cap to allow for driving into surface soil. The steel tubes can also be fitted with aluminum or stainless steel liners for the collection of undisturbed samples. Polyethylene liner caps are used to seal the ends of the tube after sample collection. Soil core samplers can be used to obtain soil samples for chemical or geotechnical analysis. The use of liners allows for the collection of undisturbed samples, minimal loss of volatiles, and easy shipping to the analytical laboratory. The procedures outlined below shall be followed when collecting surface soil samples using this method.

1. Attach a stainless steel cap to the soil core sampler.
2. Attach the sampler and cap assembly to the hammer.
3. For the collection of undisturbed soil samples, install stainless-steel liners in the sampler.
4. Push the hammer and sampler into the surface soil. For dense soil, turn hammer slightly clockwise to enhance penetration.
5. Once the desired sample depth is reached, retrieve sampler to the surface and detach the sampler from the hammer.
6. Samples for VOC analysis require special handling (refer to SOP-13 for details).
7. To collect samples for chemical analysis other than VOCs, empty contents of the sampler into a stainless steel bowl for homogenization following the methods outlined in SOP-16. Prior to homogenization, remove twigs, rocks, leaves and other undesirable debris if they are not considered part of the sample.

5.0 DECONTAMINATION

All equipment used in the sampling process shall be decontaminated prior to field use and between sample locations. Decontamination procedures are presented in SOP-3. Personnel shall don appropriate personal protective equipment as specified in the project-specific work plan. Any investigation-derived waste generated in the sampling process shall be managed in accordance with the procedures outlined in SOP-7.

STANDARD OPERATING PROCEDURE 16A

PREPARATION OF SAMPLES FOR EVALUATING 0-TO-2-FOOT AND 2-TO-10-FOOT INTERVAL: SUBSAMPLING AND COMPOSITING FOR SAMPLES TO BE ANALYZED FOR METALS, FLUORIDE, AND RADIONUCLIDES

STANDARD OPERATING PROCEDURE 16A

PREPARATION OF SAMPLES FOR EVALUATING 0-TO-2-FOOT AND 2-TO-10 FOOT INTERVAL: SUBSAMPLING AND COMPOSITING FOR SAMPLES TO BE ANALYZED FOR METALS, FLUORIDE, AND RADIONUCLIDES

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1.0 INTRODUCTION

Fill and native soils will be collected according to SOP-10, Soil Boring and Drilling and SOP-14, Subsurface Soil Sampling at the locations specified in the *Supplemental Remedial Investigation Work Plan for the FMC Plant Operable Unit.* The resulting native samples will be subsampled and composited according to the specifications and directions detailed in this SOP. Native soils are primarily loess soils as well as some colluvial and alluvial soils. Fill samples (e.g., slag, silica, ore, and precipitator dust) will require grinding prior to compositing and subsampling; these samples will be addressed according to contracted laboratory SOPs.

This SOP addresses the collection of native soils collected over the 0-to-2-foot and the 2-to10-foot intervals below ground surface (bgs) and the 0-to-2-foot intervals below native soil (bns). This SOP is to be used for samples that will be non-spatially composited sample as well as for those samples that will be spatially composited with other samples.

The 0-to-2-foot and the 2-to-10-foot samples intervals include:

- **Samples collected in support of the Risk Data Concept Model.** Representative subsamples of between four and twenty 0-to-2-foot bgs and 2-to-10-foot bgs samples will be composited and submitted to the off-site laboratory for analysis. *The 0-to-10-foot bgs sample referred to in the SRI Work Plan is a numerical average of the 0-to-2-foot bgs and 2-to-10-foot bgs samples.*
- **Samples collected for the Supplemental Feasibility Study (SFS) support activities.** Representative subsamples of five 0-to-2-foot bns samples will be composited and submitted to the off-site laboratory.
- **Samples collected in support of cap delineation studies.** These 0-to-2-foot bns or 0-to-2-foot bgs and 2-to-10-foot bgs intervals will be subsampled and submitted to the off-site laboratory for analysis.

- **Samples collected for Reference Area studies under slag, ore and coke.** These 0-to-2-foot bns intervals will be subsampled and submitted to the off-site laboratory for analysis.

Note that 0-to-2-foot and the 2-to-10-foot samples that are to be analyzed for elemental phosphorus (P4), metals, fluoride and radiological parameters are described in SOP-16B and SOP-16C.

The field sampling team will place the entire sample or multiple samples in a labeled, appropriately-sized sample container that will then be sent to a sample preparation and compositing area (either on-site or at an off-site area) to process a representative subsample that will be sent to the off-site laboratory for analysis. Procedures performed in the sample preparation and compositing area include mixing and subsampling to fill the appropriate sample container for laboratory analysis.

This SOP was based on the following assumptions;

- Soil density range of 1.0 grams per cubic centimeter (g/cc) to 1.8 g/cc
- Based on data review of RI soil recovery (densities and compaction rates), 100% recovery is assumed to be between 80% and 100% of a two-foot split-spoon sampler
- Approximately 2-inch or 3-inch outer diameter (OD) cores samples
- Larger particles (e.g., greater than 0.25-inches) have a very small surface area compared to the native loess soils
- The COCs and COPCs will not have penetrated into the larger particles (e.g., naturally occurring gravels and rocks)
- Analyzing the fines will result in a high bias of the unit mass concentration compared to an analysis that included all particle sizes

The sampling, subsampling and compositing procedures in this SOP are not designed for the collection of organics or P4.

2.0 DEFINITIONS

bns – below native surface

bgs – below ground surface

Composite Sample – A physical combination of two or more samples.

Collocated Sample – Two or more portions collected as close as possible in time and space so as to be considered identical.

Increment – A group of particles extracted from a batch of material in a single operation of the sampling device.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

SRI Project Manager: Overall management and responsibility for the boring/drilling program and sampling methods with input from other key project staff and FMC personnel.

Quality Manager: Performs project audits. Ensures project-specific data quality objectives are fulfilled.

SRI Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Implements drilling/coring program and supervises other sampling personnel. Prepares daily logs of field activities and chain-of-custody forms.

Field Technician (or other designated personnel): Assists the FTL and/or field geologist, hydrogeologist, or engineer in the implementation of field tasks.

Compositing Technician (or other designated personnel): Coordinates with the FTL by operating the sample preparation and compositing area. This person or these persons subsample and generate composite samples according to SOPs.

4.0 EQUIPMENT

- Personal protective equipment (PPE) as defined in the Health and Safety Plan.
- Plastic sample containers capable of holding up to 2 liters of soil (½-gallon).
- Plastic sample containers capable of holding up to 3 liters of soil (1-gallon).
- Water, sinks and cleaning materials.
- A variety of different-sized spatulas, scoops, and other material handling equipment.
- Plastic or stainless steel containers capable of holding and mixing the subsample increments
- Six foot flat surface with a mounted backstop
- Disposable sheets of butcher paper
- Stainless-steel rectangular sample scoops of 0.5-inch and 0.75-inch width for division and collection of increments
- Tape measure, ruler or yard stick
- No. 4 mesh sieve

5.0 COLLECTION AND PREPARATION OF SAMPLES

5.1 SAMPLE COLLECTION

The boring/drilling team will bring the sample to the surface as described in SOP-14 (e.g., a split-spoon sampler or hand auger). After the sample is brought to the surface, the sample will be measured, logged for soil type, and placed in a clean container, labeled, and hand delivered to the sample preparation area. All non-spatially composited samples will be mixed and subsampled. For samples collected in support of the Risk Data Concept Model, between four and twenty, 0-to-2-foot bgs and 0-to 10-foot bgs individual samples will be composited as described below and a representative subsample submitted to the off-site laboratory for analysis. The 0-to-10-foot bgs sample will be a numerical average of the 0-to-2-foot bgs and the 2-to-10-foot bgs samples. A 2-to-10-foot bgs sample will be comprised of four two-foot increments (2-to-4-foot bgs, 4-to-6-foot bgs, 6-to-8-foot bgs, and 8-to-10-foot bgs). These increments will be combined in the field prior to delivery to the sample preparation area. For samples collected for SFS support activities five individual 0-to-2-foot bns samples will be composited as described below and a representative subsample submitted to the off-site laboratory for analysis. Samples that are spatially composited will be collected in individual containers and delivered to the sample preparation area in individual containers. They will be composited in the sample preparation area.

Approximately 100% sample recovery in the native loess soil should be attainable using a split-spoon sampler. However, apparent sample recovery over a two foot interval could vary between 80% and 100% based on the density of the material and amount of compaction. Sample recovery of less than 50% will require that a new borehole be drilled to collect the desired sample interval. New borings locations will be determined in the field based on site surface conditions. Typically, if there are no restrictions such as a utility line, boulder, or hill slope, the boring will be moved by randomly selecting a direction (north, south, east, or west) and moving between two and five feet in that direction. All deviations and pertinent observation will be recorded in the field documentation.

5.2 CHAIN-OF –CUSTODY

Chain-of-custody procedures are initiated at the time of sample collection. All samples will be maintained under chain-of-custody (i.e., 1) in a person’s physical possession, 2) in view of the person after taking possession, or 3) secured by that person so that no one can tamper with it) until transferred to the sample preparation and compositing area, at which time internal chain-of-custody procedures will be employed.

The sample preparation and compositing area is a secure area with controlled access and the equipment and personnel to prepare, subsample and composite samples in preparation for shipment to analytical laboratories. Chain-of-custody will be maintained according to SOP-4, Field Documentation.

5.3 COLLOCATED SAMPLES

For data collected in support of the cap delineation and reference area studies, samples will be subsampled and submitted to the off-site laboratory. For data collected in support of the Risk Data Concept Model, between four and twenty 0-to-2-foot bgs and 2-to-10-foot bgs sample intervals will each be composited and representative subsamples obtained. For data collected to support SFS activities five 0-to-2-foot samples will be composited and a representative subsample obtained. Periodically a collocated composite sample will also be collected, requiring duplication of the sampling and compositing scheme described in Section 5.4. The original and collocated samples are handled in the same manner.

5.4 SUBSAMPLING METHOD

The subsampling of a native soil sample is performed as follows:

1) Sieve native colluvial and alluvial soil with a #4 (4.75 mm/ 0.187 inch) mesh sieve to remove large debris such as sticks and rocks. Samples of native loess soil do not require sieving unless rocks greater than approximately 0.25 inches are visible in the sample.
2) Remove any remaining artifacts (e.g., roots, twigs, etc) that passed through the sieve.
3) Weigh and record mass of rocks, debris, or artifacts removed. Record a description of removed material. Archive removed material by placing it in a labeled container.
4) Transfer the sieved material into a stainless steel bowl or the field plastic sample container. Disrupt clods or other soil aggregates using a clean spatula, spoon, ceramic mortar, or similar device. Thoroughly mix the sample in the container using a clean spatula, spoon, or similar device.

5) Spread the soils on an inert surface (e.g., butcher paper) by slowly pouring the materials while moving the sample container from left to right to form a rectangular pile. The entire sample is emptied in this manner.

6) Use a spatula or other tool to shape the pile into a rectangle (four feet long) with an even top surface.

7) Lay a tape measure or similar device along the long side of the rectangle and with a goal of a minimum of 20 equal-sized segments. Determine the width of each segment (e.g., a 48-inch long rectangle could be divided into 24 two-inch wide segments).

8) Make cross-sectional cuts with a stainless steel rectangular scoop. The cuts are made perpendicular to the long side of the rectangle and at the center of each segment.

9) Collect at least 20 increments by means of the scoop. The sample material collected within the scoop will comprise the increment and in its entirety be emptied into a holding container. Make sure that the scoop has been completely emptied before collecting the next increment. If necessary, use a clean spatula or similar device to empty the scoop. Collecting increments every two inches along the four foot pile will result in 24 increments per subsample.

10) Thoroughly mix all increments in the holding container using a spoon, spatula or similar device.

11) Transfer the entire subsample into a labeled, pre-cleaned, sampling container provided by the laboratory. If more than one sample container is used, alternate shoveling employing a scoop or spatula to fill the required containers. The material in the sample container will be sent to the laboratory for analysis for fluorides, metals (except for mercury) and radionuclides.

12) For the subsample of mercury, reshape the remaining soil according to Step 6. Use the 0.5-inch scoop to collect a minimum of 20 increments to form a subsample according to Steps 7 through 10.

13) Transfer the entire subsample for mercury into a labeled, pre-cleaned, sample container provided by the laboratory and placed into a cooler with ice to

achieve a sample temperature of 4 °C. The material in the sample container will be sent to the laboratory for analysis of mercury.

14) Ship labeled containers to the laboratory according to the procedures outlined in SOP-4 and SOP-12 and handle the remaining material according to SOP-7.
15) Decontaminate equipment and work surface.

Notes:

a) Sieving of the sample will remove rocks and other artifacts from the native soil samples. This method will leave the high surface area particles for analysis.
b) The scoops used to make the transverse cuts work best if they are thin, and higher than the depth of the rectangular pile.
c) The scoops are inserted such that they are perpendicular to the long side of the rectangular pile of soil.
d) All material between the scoops is removed to the extent practicable.

5.4.1. SUBSAMPLING OF AN INDIVIDUAL 0-TO-2-FOOT SAMPLE

Individual (non-composited) 0-to-2-foot bgs or bns samples will be collected in support of cap delineation and reference area studies. The required sample to be sent to the laboratory will subsampled according to the methods outlined in Section 5.4. Samples will be collected with a split-spoon sampler or hand auger with a 2-inch or 3-inch OD. The pile will be shaped to form a rectangle that is 4 feet long, 3 to 4 inches wide, and 0.5 to 1.5 inches high. To collect enough volume for the metal, fluoride, and radionuclide analysis and collect at least 20 increments, a 0.5-inch or 0.75-inch scoop will be used. If the amount of subsample in the holding container still does not meet the volume required for laboratory analysis (enough material to fill a 16 oz container), then steps 6 through 9 will be performed a second time. However, the newly formed rectangular pile will be subdivided so that the number of increments collected will result in the required volume to fill the sample containers.   For example, four additional increments equally-spaced across the reformed rectangle may be sufficient to generate the appropriate volume of sample.

5.4.2. SUBSAMPLING OF AN INDIVIDUAL 2-TO-10-FOOT SAMPLE

Individual (non-composited) 2-to-10-foot bgs samples will be collected in support of cap delineation. These 2-to-10-foot bgs samples will be brought to the surface in four two-foot split spoons samplers (2-to-4-foot bgs, 4-to-6-foot bgs, 6-to-8-foot bgs, and 8-to-10-foot bgs) with a 2-inch OD. The four two-foot intervals will combined into one container in the field and delivered to the sample preparation area to be subsampled according to the methods outlined in Section 5.4. The pile will be shaped to form a rectangle that is 4 feet long, approximately 3 to 4 inches wide, and approximately 1 to 1.5 inches high. If the amount of subsample in the holding container still does not meet the volume required for laboratory analysis (enough material to fill a 16 oz container), then steps 6 through 9 will be performed a second time. However, the newly formed rectangular pile will be subdivided so that the number of increments collected will result in the required volume to fill the sample containers. For example, four additional increments equally-spaced across the reformed rectangle may be sufficient to generate the appropriate volume of sample.

5.4.3. COMPOSITING AND SUBSAMPLING OF 0-TO-2-FOOT SAMPLES

This compositing scheme applies to samples collected in support of risk and SFS data collection activities. For the risk data collection, between four and twenty 0-to-2-foot bgs samples are combined to create a mechanically averaged sample for off-site laboratory analysis. For the SFS data collection, five 0-to-2-foot bgs samples, collected from the same quadrant, are combined to create a mechanically averaged sample for analysis by the offsite laboratory.

Samples will be collected with a split-spoon sampler or hand auger with a 2-inch OD. The required number of 0-to-2-foot sample intervals will be collected in individual sample containers in the field. The individual samples will be sieved as necessary according to Steps 1 to 4 in Section 5.4. If the percent recovery from each of the samples is at least 80%, then the samples will be composited into one container for subsampling. If the percent recovery from any of the samples is less than 80%, then equal masses will be collected for compositing and subsampling based on the lowest recoverable mass. Once composited into one container, the pile will be shaped to form a rectangle that is 4 feet long. The width and height of the pile will vary based on the number of samples to be composited. However, for four to six samples, the pile will be approximately 3 to 4 inches wide, approximately 1 to 1.5 inches high. The pile will be subsampled according to steps 5 through 15 in Section 5.4.

Fractional shoveling may be considered as a subsampling alternative if the number of increments to be composited (up to 20) is too large to be handled according to the methods in Section 5.4.

Fractional shoveling will be performed using the following guidelines:

1) Break up any clumps with a clean spatula or spoon, while keeping the sample in a single pile.
2) Choose a scoop/spatula size that results in no less than 20 scoops per fraction and preferably 30 or more scoops per fraction. It will usually be advantageous to place the fractions in containers to facilitate later handling of the material.
3) There should be an equal number of scoops per fraction.
4) If interrupted during the splitting process, the technician should leave the scoop in the last fraction to receive a scoop, so the technician can restart without introducing a bias.
5) As the original pile dwindles, it may be advantageous to switch to a smaller scoop to ensure that all fractions get an equal number of the remaining scoops.
6) One of the fractions is randomly chosen.
7) The randomly-chosen sample will be placed in the sampling containers
8) Ship labeled containers to the laboratory according to the procedures outlined in SOP-4 and SOP-12.
9) Decontaminate equipment and work surface.

5.4.4 COMPOSITING AND SUBSAMPLING OF 2-TO-10-FOOT SAMPLING

This compositing scheme applies to samples collected in support of risk data collection activities. For the risk data collection, between four and twenty 2-to-10-foot bgs samples are combined to create a mechanically averaged sample for off-site laboratory analysis.

Samples will be collected with a split-spoon sampler or hand auger with a 2-inch OD. The required number of 0-to-2-foot sample intervals will be collected in individual sample containers in the field. The individual samples will be sieved as necessary according to Steps 1 to 4 in Section 5.4. If the percent recovery from each of the samples is at least 80%, then the samples will be composited into one container for subsampling. If the percent recovery from any of the samples is less than 80%, then equal masses will be collected for compositing and subsampling based on the lowest recoverable mass. Once composited into one container, the pile will be shaped to form a rectangle that is 4 feet long. The width and height of the pile will vary based on the number of samples to be composited. The pile will be subsampled according to steps 5 through 15 in Section 5.4.

Fractional shoveling may be considered as a subsampling alternative if the number of increments to be composited (up to 20) is too large to be handled according to the methods in Section 5.4. Fractional shoveling will be performed according to the methods in Section 5.4.3

6.0 REFERENCES

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